
The
MINING
CONGRESS
JOURNAL
JULY
1936

GOOD JUDGEMENT

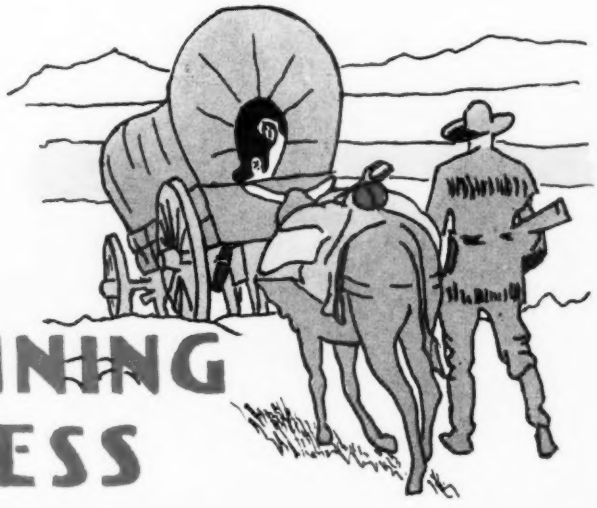
1859 . . . . . Colorado Gold Rush . . . deserts, plains and great mountains to be overcome and won by man. Working their way across these came hard men . . . men used to suffering . . . men who could fight! Their search for mineral wealth took good judgement, hard work and foresight. . . .

1936 . . . . . The Annual Metal Mining Convention & Exposition . . . Denver . . . fast trains and planes . . . faster communications . . . modern hotels . . . the comforts and luxuries of a progressive state . . . Colorado.

Prospecting in 1859 was for gold and precious metals . . . today the search continues for new machinery and modern mining methods. Men are yet adhering to those principles set down in 1859 . . . they are still using and showing good judgement, initiative and sound reasoning . . . this is why they are now making plans to attend the Metal Mining Convention & Exposition in Denver September 28 - October 3, 1936.

They will come to present papers, to view the exhibits and to entertain friends . . . but they will also come to buy!

We ask that you now make plans to exhibit, to attend meetings, to re-new old acquaintances at Denver, the host city of the Annual Metal Mining Convention and Exposition, in September, sponsored by the American Mining Congress, Munsey Building, Washington, D. C.



THE AMERICAN MINING CONGRESS

The Mining Congress Journal

Volume 22 JULY, 1936 Number 7

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THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
John A. Roebling's Sons Co.,
Trenton New Jersey
JAR
Roebling...
The pacemaker in
wire rope development

DOWN GOES DEAD WEIGHT!

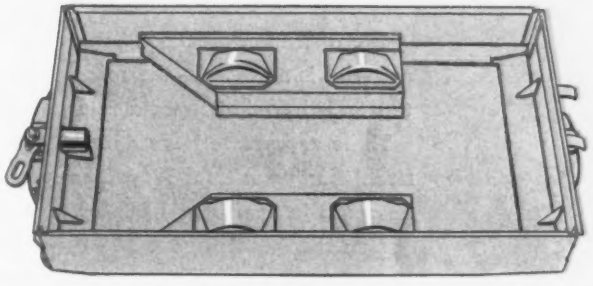
UP GOES STRENGTH!

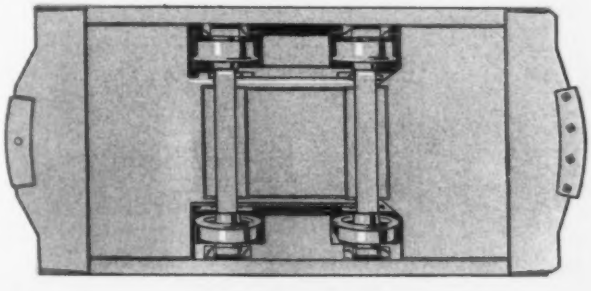
in these new Bethlehem Mine Cars

By utilizing the great strength and rust-resistance of alloy steels, Bethlehem is manufacturing mine cars that score as great an improvement in haulage efficiency over the ordinary steel car as that type did over wood and composite cars. Dead weight is slashed drastically and at the same time cars are more rugged, more resistant to corrosion. Economies result from both saving on dead weight hauled and lower maintenance.

Bodies and underframes of these cars, of alloy steel, welded, have the strength of what is practically one-piece construction. Drop axles of such design that they can't sag assure that wheels will stay in position. Wrought steel wheels that don't break or chip keep the cars in service instead of in the shop. Anti-friction bearings, sealed in, save power and cut down on greasing costs.

These new Bethlehem mine cars make use of every recent development in materials, design and fabricating practice to raise the efficiency of haulage in the mine.



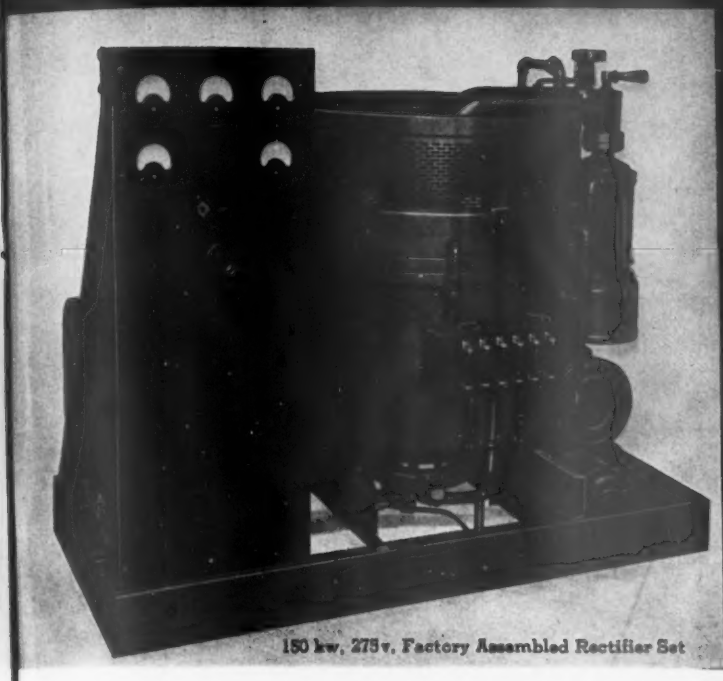


BETHLEHEM STEEL COMPANY, *General Offices:* Bethlehem, Pa. *District Offices:* Albany, Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Honolulu, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Washington, Wilkes-Barre, York. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

PROVEN!



150 kw, 275 v. Factory Assembled Rectifier Set

First American Rectifier in Substation for Coal Mines, Installed 1927

FOR MINE HAULAGE SYSTEMS

Lower Maintenance and Power Costs

NINE years of successful operation of the first mercury arc rectifier used on a mine haulage system has demonstrated its suitability and economy for this service. The substation at the right contains a 300 kw, 550 volt Brown Boveri rectifier, such as built by Allis-Chalmers. For nine years this rectifier has continuously supplied d.c. power to the haulage system of the Pocahontas Fuel Company's Rolfe mine, W. Va. The substation is operated by the Appalachian Electric Power Company.

During the years in which accurate records were kept, the average yearly maintenance cost of this rectifier was $79.60, against $198.20 for automatic motor-generator sets and $255.50 for automatic converters, all operated on same power system and serving mines.

In spite of the fact that this rectifier was one of the first installed in this country and of foreign make, at no time during the nine years' operation was the assistance of a factory representative required for its maintenance. This rectifier replaced a 300 kw synchronous motor generator and raised the overall substation efficiency from 50 to 85%. The above records check closely with the records of over 250,000 kw of Brown Boveri type rectifiers installed in railway substations and industrial plants throughout the country.

The principal advantages of Allis-Chalmers rectifiers over converting equipment of the rotating type are: High overall conversion efficiency, particularly at partial loads; no-load idling losses one-third to one-fourth that of rotating equipment. With low machine load factor generally prevailing in mine substations, rectifiers will reduce power bills 15 to 25% ... Maintenance cost about one-third that of rotating equipment ... Freedom from commutation difficulties and absence of synchronizing forces result in high momentary overload capacity ... Unharmed by a.c. line disturbances ... Easy, instantaneous starting and no reversal, permitting automatic control at little expense.

Write for Descriptive Literature.

MERCURY ARC POWER RECTIFIERS

ALLIS-CHALMERS

THERE IS

GOLD

IN THIS NEW LOADER

THIS is the New L-400 Loading Machine that Jeffrey built . . . that stole the show in Cincinnati . . . that is destined to lower loading costs in the mine . . . that will give you capacity in excess of other loaders.

The sweeping action for gathering loose coal . . . the digging action for pulling down tight coal . . . mean greater ability to handle large tonnages with minimum breakage. Quick, easy maneuvering in response to finger-touch controls . . . simple, rugged and accessible construction . . . are not to be overlooked in the New Jeffrey L-400 Loader.

Of course, Jeffrey gives you the best in Loading Machines . . . and why not? Founded in 1877 . . . Jeffrey has developed many of the basic principles found in all Mining Machinery today. When you specify Jeffrey you know that you are getting the most for your equipment dollar.

Send for Bulletin No. 626-B.

The Jeffrey Manufacturing Co.

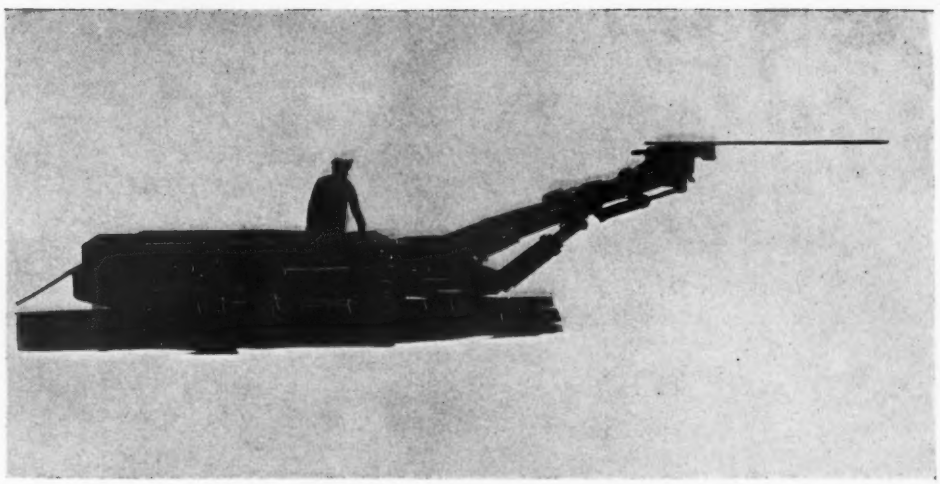
958-99 North Fourth Street

Columbus - - - - Ohio

Illustration at the right shows the "Finger-touch" Hydraulic Controls, which take all the hard work out of Loader operation . . . every adjustment being made quickly and easily by merely touching one of the six conveniently located levers.

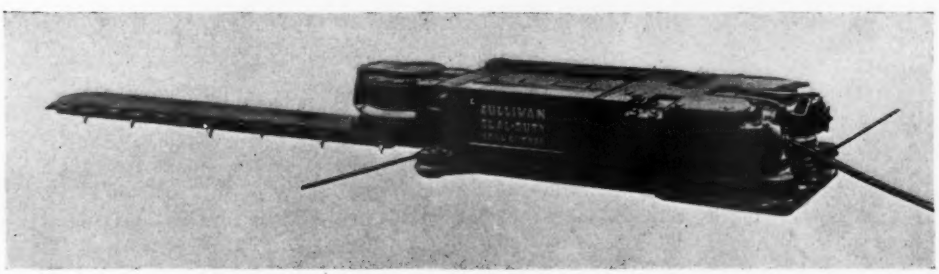
A FEW OF THE NUGGETS

- Capacity . . up to 8 tons per minute
- Finger-touch, Hydraulic Control
- Simplicity of design: but one motor
- Modified 3-point suspension, for trouble-free tramming
- Frontal-attack type
- Instant maneuverability
- Automatic cable reel



7AU

The one and only genuinely universal track cutter that will cut horizontally any place between the roof and floor — from one foot below to eight feet above rail. In addition, it will centershear, ribshear, angleshear, slab cut and slabshear at any point within 21 feet of the track. The flexibility of the Sullivan Universal adapts it to any condition of cutting and allows modification of mining methods according to consumer demands. It is the fastest of all track cutters.



8-B

The Sullivan "Dual-Duty" is something entirely new in coal cutters. Performs equally as well as a longwall or shortwall and is super-powered for faster cutting and long continuous runs.

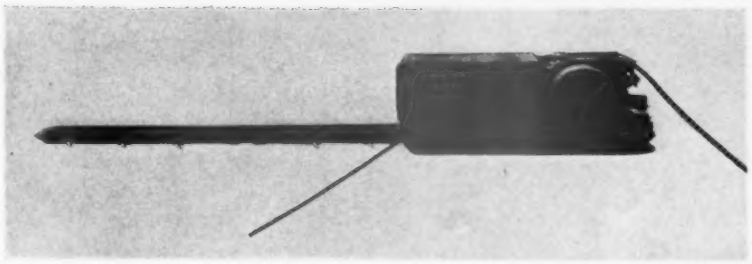
SULLIVAN

307 NORTH MICHIGAN AVENUE

The Sullivan 7AU is licensed under patents to E. C. Morgan. Patents No. 1,706,961—1,706,962—1,707,132—1,953,325—1,953,326

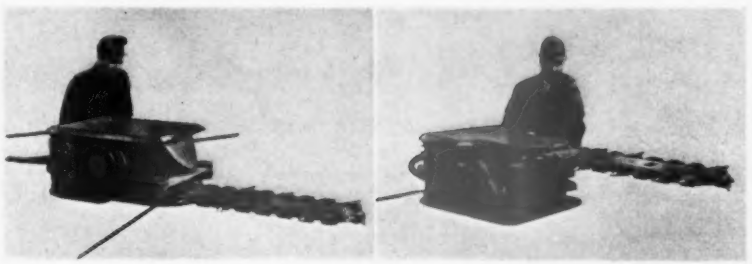
6-B

The Sullivan "Master" shortwall, a low built, high-powered, coal cutter for thin seams embodying many new and outstanding features to be found in no other low vein shortwall.



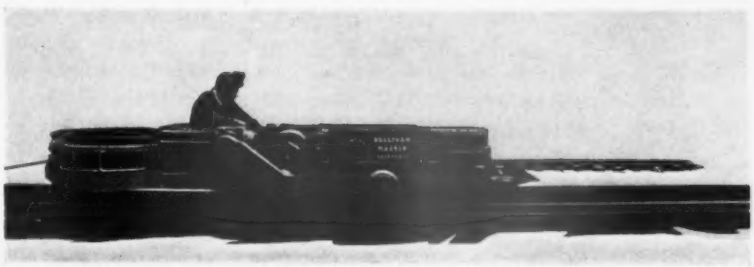
7-B

The Sullivan "Super" shortwall for thick seams. A super-powered coal cutter possessing many new features of construction that make it the fastest of all shortwall coal cutters.



5-B

The Sullivan "Buddy," the miner's helper. A small, light weight, limited duty coal cutter for each working place. This machine may be furnished with the bar at the floor line or inverted as illustrated.



TRUCK

The Sullivan "Two Speed" power truck for use with Sullivan's new "Master," "Super" and "Dual-Duty" coal cutters. Furnished in either drop-end or tip-turn types. Possesses 12 new and outstanding features that add 10% to coal cutter capacity.

MACHINERY CO.

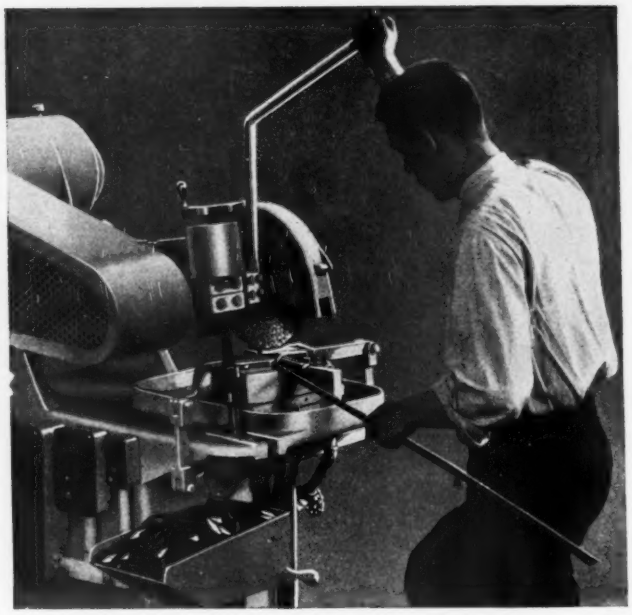
CHICAGO, ILLINOIS, U. S. A.

Announcing!

a revolutionary development

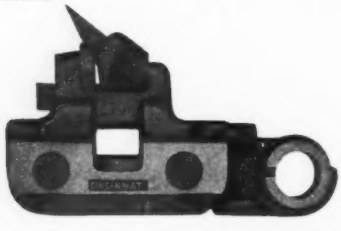
The New Cincinnati Bit Method

- **FASTEST** — Operators at recent Mining Congress saw one man make as many as 50 tempered cutting points in one minute.
- **CHEAPEST**—Bits made by this method outlast ordinary mine sharpened bits several times over.
- **MOST EFFICIENT**—Duplex Bits use less power, cut faster and set quicker.



THE NEW DUPLEX BIT MACHINE

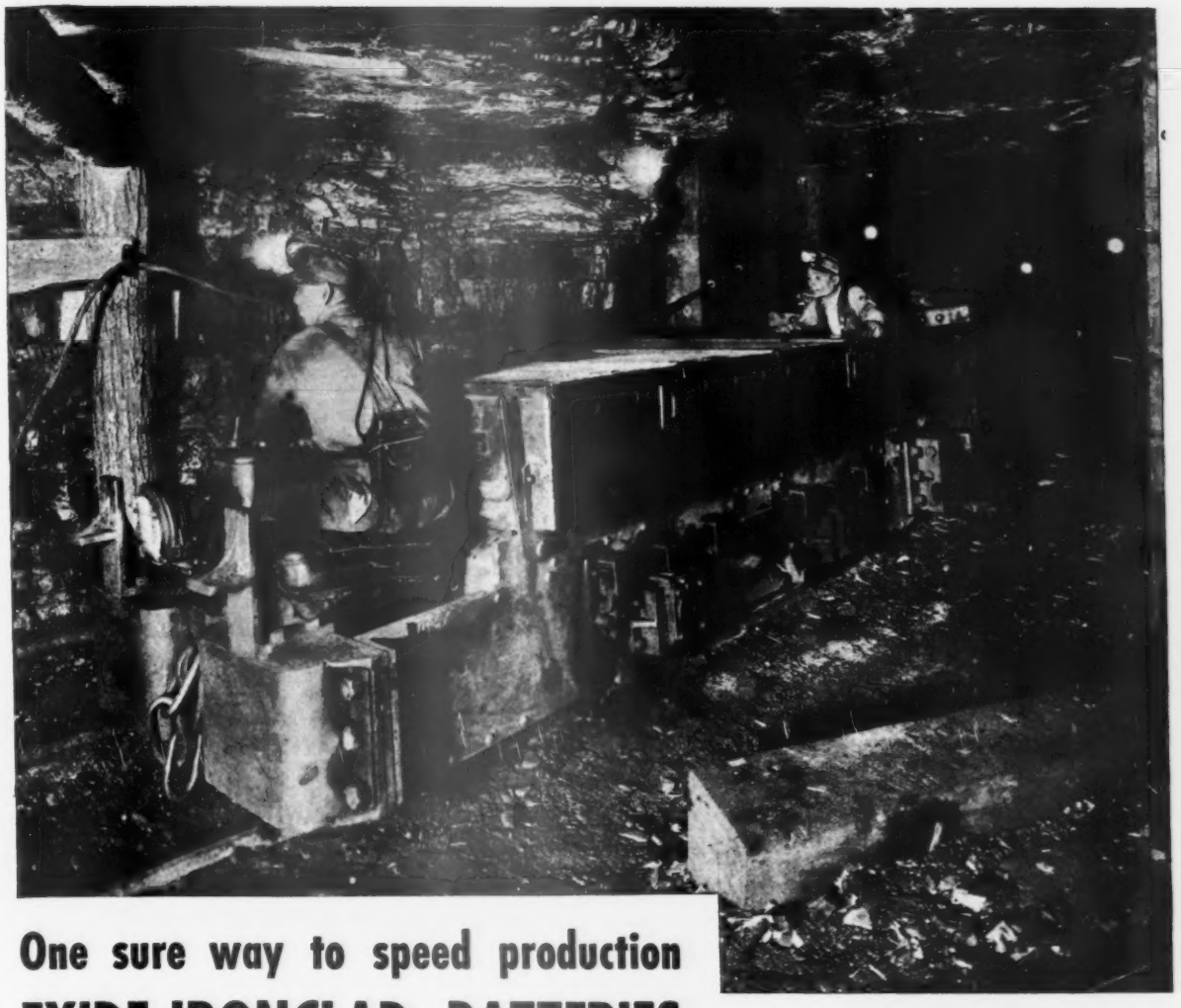
Bars of alloy tool steel hardened and tempered in our plant, are cut into finished Duplex bits at the mine in one simple operation by the Duplex Bit Machine. These bits are used in the Cincinnati Duplex Chain.



The Cincinnati Duplex Chain and Bit increases production, makes coarser cuttings, uses less power and decreases machine maintenance costs. It will pay you to modernize your cutting equipment as soon as possible. To cut costs start using Cincinnati Duplex Chains now. You can either buy the bits from us or make them at the mine. Write us for complete information.

The Cincinnati Mine Machinery Co.

2980 Spring Grove Ave., Cincinnati, O.



One sure way to speed production

EXIDE-IRONCLAD BATTERIES

FOR fast switching service in mechanized mines, battery locomotives powered by Exide-Ironclads can speed up production and cut costs.

With modern loading machines able to load a five-ton car in less than a minute, haulage can easily fall behind unless both the system and equipment are adapted to mechanized conditions.

Most frequently, loaded cars are hauled out to the panel entry only a few at a time and pushed into an adjacent room, while empties are picked up from another nearby room. Rapid exchange of cars is necessary in order to cut down the idle time of loading machines.

Under such conditions, the storage battery locomotive equipped with Exide-Ironclad Batteries is ideal. It is a self-contained unit that responds instantly to the controls, providing swift, smooth acceleration.

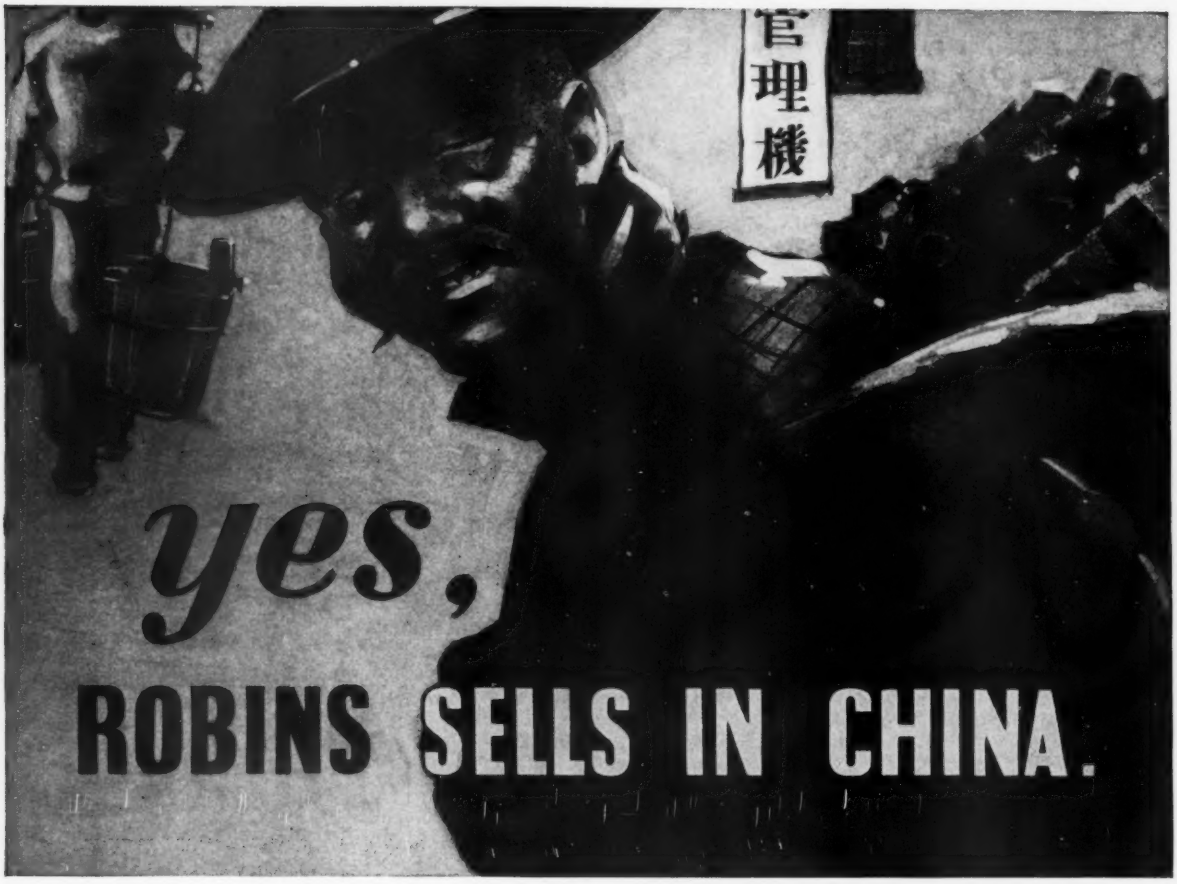
Exide-Ironclads, with their long life and low maintenance costs, mean economy in mine haulage as well as increased production. Write for free booklet, "The Storage Battery Locomotive for Underground Haulage."

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Exide
IRONCLAD
BATTERIES

WITH EXIDE MIPOR SEPARATORS

"MIPOR," Reg. U. S. Pat. Off.



Efficient mechanized material handling is of value beyond labor saving. It assures a uniform flow, eliminates choke points, and reduces breakage of product. But economics too are of importance. A Robins Material Handling System pays for itself in a definite time through lower costs of power and labor. But the buyer gets more . . . he gets as an extra dividend the control of his product travel while he saves money in lower handling costs. That's why Robins equipment is displacing coolie labor in China.

MATERIAL HANDLING
ROBINS
EQUIPMENT

EQUIPMENT ITEMS

Conveyor Idlers
Screens
Crushers
Belt Trainers
Feeders
Mine Conveyors
Boom Conveyors
Belts

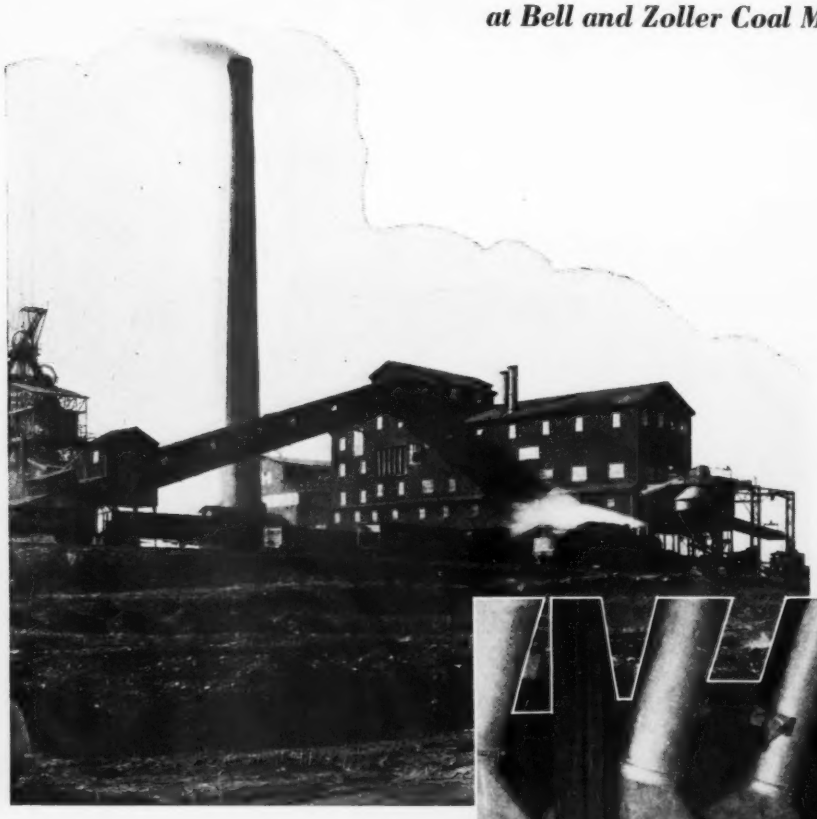
Robins designs and makes all types of complete systems for conveying, elevating, crushing, screening and loading coal at mines and preparation plants. Robins also markets the various units that comprise these complete systems.

Robins products are described in various bulletins. Send for those of interest to you.

Robins Conveying Belt Co.
15 Park Row, New York City
Please send me bulletin describing.....
Name.....
Firm.....
Address.....
City ..... State.....

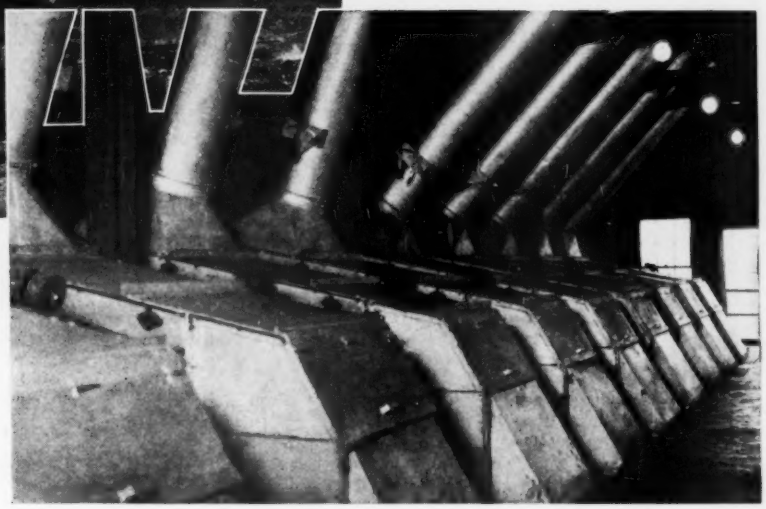
STUMP AIR FLOW

at Bell and Zoller Coal Mining Company, Ziegler, Ill.



THE Stump Air-Flow Coal Cleaner is the simplest, cheapest and most compact air-cleaner ever designed. Proof of the enthusiastic approval of the industry is shown by its steadily increasing use — at present there are—

15 plants—67 units



Stump Air Flow Cleaner Floor
10 Units—Capacity 240 Tons Per Hour

This machine is only one of our many units developed for modern and economical coal preparation. "R & S" have thirty years of experience in designing and construction of coal tipples, coal washeries, dry cleaning plants, and dedusting plants, and have an unparalleled record for performance and low operating and maintenance costs.

Whatever your requirements may be our engineers are prepared to find the most effective and economical solution to your problem. We invite your inquiry and unlimited use of our consulting service and testing plant and laboratory, without obligation to you.

ROBERTS and SCHAEFER CO.

Engineers and Contractors—Wrigley Building, Chicago

3885 Beachwood Blvd.
PITTSBURGH, PA.

514 Ninth Avenue
HUNTINGTON, W. VA.

P. O. Box 55
DENVER, COLO.

It HIT the NAIL on the HEAD

ACCIDENT? No, sir! It takes a keen eye and a practiced hand to hit the nail on the head. And so it was when O-B engineers set about to develop a dependable heavy duty trolley shoe for mine locomotives. Keen eyes saw the need for the best metal in the shoe, proper electrical characteristics and a rugged construction. Practiced hands transferred designs into the finished product. The result? Mine operators got just what they needed. The new shoe hit the nail on the head.

But keen eyes and practiced hands design and manufacture every O-B product. Line materials, rail bonds, other locomotive equipment, safety and control devices—all reflect the 48 years of experience in making dependable, long life, trouble-free equipment, the kind that results in fewer production delays and greater profits.

It is no accident that the O-B Heavy Duty Trolley Shoe and Harp are preferred in so many mines.

1834-M

OHIO BRASS COMPANY
MANSFIELD, OHIO

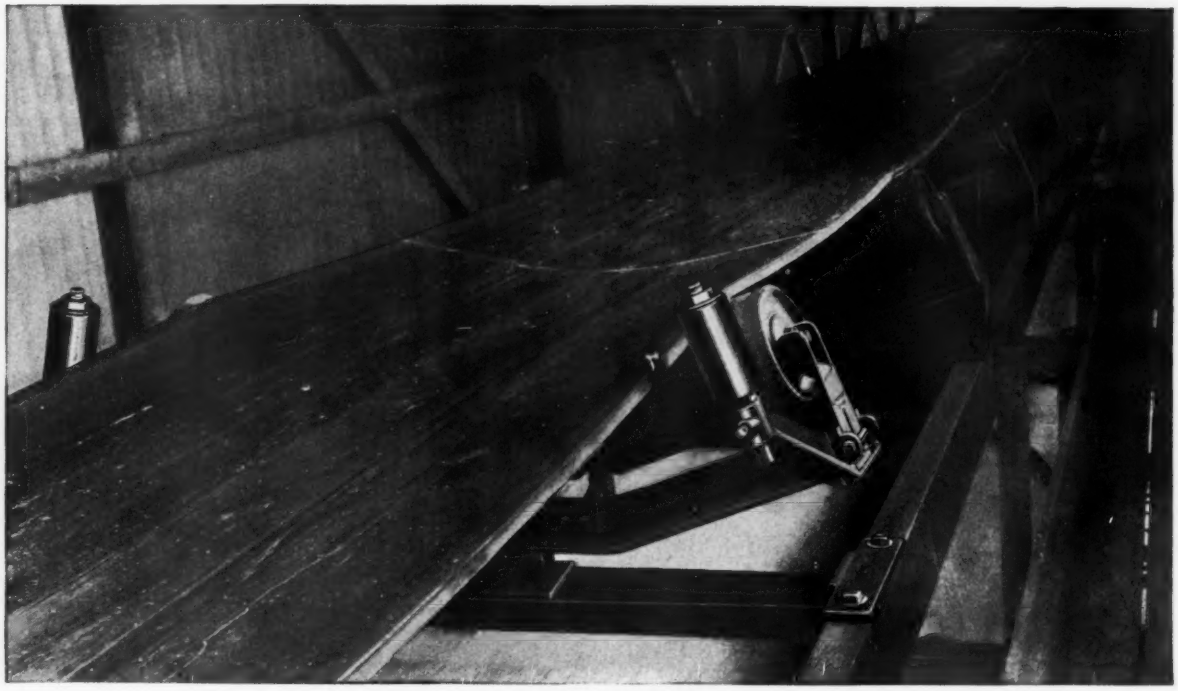
CANADIAN OHIO BRASS COMPANY, LIMITED
NIAGARA FALLS, ONT., CANADA

Specify O-B, and you specify Dependability

LINK-BELT

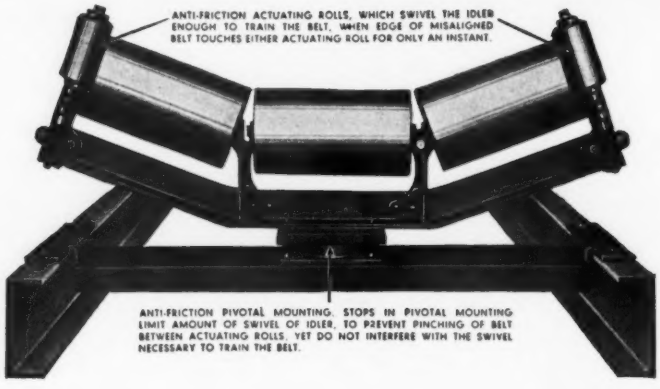
POSITIVE SELF-ALIGNING IDLER

Keeps Troughed Conveyor Belts Lined Up Without Injuring Belt Edges



● This Link-Belt POSITIVE Self-Aligning Idler automatically and positively maintains troughed conveyor belts central at all times. It has met with unqualified success, and is preferred by many who have heretofore been using the counter-weighted disc type of self-aligning idler.

Either type is to be greatly preferred to using stationary "guide idlers," which do not correct or overcome belt misalignment, but merely restrain forcibly any further sidewise movement of the belt. For proper training, and longer life of the belt, use the pivoted self-aligning idler.



LINK-BELT PRODUCTS INCLUDE:

Elevators and Conveyors of all types . . . Feeders . . . Vibrating Screens . . . Skip Hoists . . . Bucket Carriers . . . Portable Loaders . . . Speed Reducers . . . Variable Speed Transmissions . . . Silverstreak Silent Chain Drives . . . Silverlink Roller Chain Drives . . . Chain Drives of all types—Malleable Iron, Promal or Steel . . . Elevator Buckets . . . Bearings . . . Take-ups . . . Gears . . . Sprockets . . . Pulleys . . . Couplings . . . etc.

Send for Catalogs.

Send for Catalog. Return the Coupon.

LINK-BELT COMPANY

220 S. Belmont Ave., Indianapolis, Ind.

Please send copy of Folder No. 1408-A

Name .....

Company .....

Address .....

City ..... State .....

9534-A

COLLECTIVE BARGAINING

FROM the Magna Carta to the American Constitution, the greatest boom to mankind was Liberty; the right to life, liberty, and the pursuit of happiness. Nowhere has it been conceded that any power could destroy or alter the fundamental rights so granted to the common people.

Liberty: the right to do any act which did not tresspass upon a similar right of another. The pursuit of happiness: the right to secure the things which we desire wherever this may be done without trespassing upon the rights of others; this includes the right to sell our property or our service at a price mutually agreed upon.

Every restriction upon this right is a limitation of the right to liberty and the pursuit of happiness.

Continued reiteration by selfish interests has fooled the American people into a belief that service and the result of service (commodities) can be so distinguished that one is above the law.

It took many years of determined effort (under the leadership of that great laborite, Samuel Gompers) backed by growing political power to bring about the enactment in the Clayton Act of the phrase "labor is not a commodity." To the average mind this was a meaningless expression too trifling to justify opposition to a great organization consisting largely of voters.

As the basis of a philosophy this has been given great importance. The enactment of the Adamson Bill was the price of peace in the railroad world during the stress of the World War. Under the stress of world industrial depression, laws were enacted declaring a fact never questioned, the right of collective bargaining.

The right to bargain, the right to sell one's service or the production arising from one's labor, is an inherent right either individually or collectively, neither of which can be violated without violation of inherent rights.

Liberty is an individual, a personal right which one may exercise either alone or in association with others. The latter is collective bargaining only when the individual exercises his personal right of approval—but *giving such approval under coercion is not collective bargaining*. It is a surrender of personal liberty on the part of the individual and in practice is not collective bargaining but collective extortion.

The employer in practice is required to employ certain people, at a certain fixed wage, and for certain specified hours, and failing to accept this proposal is required to close his plant. *His right to bargain with others who are willing to work under a real agreement is absolutely denied.*

The expression "collective bargaining," in practice under labor laws enacted at the demand of a minority, does not carry any of the fundamental principles of a bargain. A bargain is a free meeting of minds, each of which is at liberty to accept or reject without reprisals of any kind or nature.

The great majority of employers stand for the fair treatment of labor. Many employers are entirely willing to submit to any requirement which increases costs so long as these costs may be passed on to the public. When these burdens are so great that markets will not absorb the output and when surplus reserves are exhausted, the plant must close and unemployment follows.

All wages must come from the joint earnings of capital, management, and labor. Of these labor will be, as it should be, the last to surrender its return.

Where there are no joint earnings there can be no permanent employment. Bargaining is an essential element of employment and prosperity. Extortion is a violation of every principle of human liberty and should not be tolerated. It is forbidden by every document of human liberties, from Magna Carta down to the present.

The Mining Congress Journal

Volume 22 JULY, 1936 Number 7

E. R. COOMBES, Editor

A Journal for the entire mining industry published by The American Mining Congress

Machines and Progress

MACHINERY THROUGH the ages has typified our industrial growth. From the Neanderthal man to the present time, machinery has led progress. Hand in hand with science and invention it is continuing to bring to the world a standard of living that defies comparison.

During the years of the depression an effort has been made to prove that the adoption of machine methods of production has contributed substantially to unemployment, but the arguments advanced do not ring true, and have been completely refuted by reliable statistics.

For instance: From 1900 to 1930, the period of greatest technological advancement in this country, there was a gain of 20,000,000 new jobs. One of each seven factory workers today has a job making some product that was unknown 50 years ago. Eighteen of the major manufacturing industries of today have been wholly developed since 1880, and they are responsible for the employment of a million workers in manufacturing alone. Between 1920 and 1930 the 19 principal growing occupations gained three times as many workers as the 19 principal vanishing occupations lost.

The figures quoted are substantiated by such reliable agencies as the National Industrial Conference Board and the Machinery and Allied Products Institute. The trend today is unmistakably toward mechanization, and even in these days of unemployment the skilled workman readily finds employment. The use of machinery opens—not closes—the door of opportunity.

A Real Issue

THESE ARE the days of the baccalaureate address. From thousands of universities and colleges boys and girls are going forth to seek their future. But how? With courage in their hearts, loyalty to their country, and faith in the American tradition of "opportunity"? President James Rowland Angell, of Yale, made a memorable address to his graduating class. In part he said:

"By slow development in the last half century we had become reconciled to drawing a line between such business enterprises as were clearly affected with a public interest, like railroads and public utilities, and such as were not. In the last few years, for reasons which have seemed to those in power wise and indeed inevitable, government has steadily sought to extend the area thus contained within its jurisdiction, and unless public opinion be clearly registered as opposed to further similar encroachment, it may confidently be expected to spread until in effect, whatever the name, we shall have something closely resembling a totalitarian state."

Thus he presents what is the real problem before us today. The slow and insidious encroachment of government into the realm of private enterprise is a serious menace to our future.

Our Alarming National Debt

SENATOR BYRD, of Virginia, well informed upon all matters pertaining to the national income and outgo, recently said, "In 1937 we will collect in taxes $1,600,000,000 more than in 1935, and still the deficit continues in an alarming amount."

Our hearing has been dulled by the repetition of such vast sums; our eyes fail to convey to the brain the magnitude of the continuously printed figures giving our mounting national indebtedness. But regardless of our dulled senses, the debt increases, and "Junior must pay the bill." It is obvious at once that Father cannot do so.

The following figures are painfully significant:

Deficit, fiscal year 1933	$5,142,953,627.00
Deficit, fiscal year 1934	7,105,050,085.00
Deficit, fiscal year 1935	7,375,825,166.00
Deficit, fiscal year 1936	7,678,709,874.00
Deficit, fiscal year 1937	8,272,554,370.00

Although these figures do not include the Soldiers' Bonus, we call attention to the fact that 1937 is planned as a record year of expenditure. It is common knowledge that he who continuously spends more than he earns faces bankruptcy. It is within the power of the American people to call a halt on such spending.

History in the Making

THE RECORD of the Seventy-fourth Congress will go down in history not so much from a record of great deeds performed, or multiplicity of measures passed, but because of the measures which "vested authority," "delegated power," and "authorized regulation."

Obviously Congress again proceeded upon the premise that the situation called for wide discretionary powers in the hands of those who must administer the legislation. It is to be devoutly hoped that these regulatory and administrative agencies will be endowed with wisdom and discretion and will handle these wide powers without undue harassment of business or usurpation of state authority.

THE CORRECT ECONOMY for the MACHINE AGE*

By A. G. McGREGOR

I HAVE journeyed 4,000 miles from a country which has been in depression for 15 years to explain why things now being done in the hope of restoring prosperity in this country will serve only to hold it firmly in depression.

The Government has a most important obligation to industry, but to interfere with economic liberty and supply and demand brings an avalanche of duties, not one of which can be satisfactorily discharged by the Government.

The Government should discharge a basic and most vital duty, a duty which only the Government is fitted to perform. I refer to the Government's obligation to the dollar. If it will discharge that obligation all need for the many other duties it is totally unfitted to perform, but which it is attempting and being urged to perform, will quickly disappear.

The control of the buying power of the dollar is surely a governmental responsibility. Its buying power, or the general price level if you like, should be put back to the 1928 level promptly and kept there. When the Government seriously considers discharging that duty *by the only possible means*, economic liberty dominated by supply and demand will route depression overnight never to return.

To try to substantiate the statements just made is the object of my address. The short time at our disposal has made it necessary to omit certain aspects of the problem and to treat some others only briefly.

No Nation Can Produce More Than It Can Consume

The belief is common in each country that it has a power to produce much beyond its power to consume, whereas no nation can ever produce by the most efficient organization possible the equivalent of more than its people would like to produce and consume. If our economy functioned naturally and in harmony with man's nature *there would always be a shortage* of labor and capital to produce, on the whole, the goods and services for which there would be a firm and ever-increasing demand. Labor would be in demand at much higher wages, and capital at much higher interest rates and profits, and each worker would be able to pick and choose his employment, and each capitalist to pick and choose the employment for his capital—economic liberty would rule.

A Near Approach to the Correct Economy—Wage and Salary Earners the Important Consumers

The experience of the U. S. between the years 1921 and 1930, while accidental, affords the best example in history of a near approach to the correct economy. In a wave of optimism and labor demands for higher wages in 1922, wholesale prices quickly rose to a satisfactory level which has not been exceeded since except for a few months in '25 and '26 and prosperity was soon in full swing. Then as volume production and the use of better manufacturing methods swelled the profits of employers, wage and salary earners *fortunately* demanded higher pay and thus increases in consuming power followed increases in productive power. Consumption balanced production.

Also during that period another very important factor was operating. *Free competition, which is the life of trade,* was constantly stimulating a demand for more and better productive facilities and thus there was employment for capital and labor in the production of producers' goods.

Unfortunately, however, wages were not high enough, and the dollar was tied to gold. *If wages had been higher* wholesale prices would not have started declining in 1926, consumption would have kept step with production, and there would have been safe employment at home for savings recklessly loaned abroad. Also there would have been sound employment for the savings recklessly employed in the inflation of stock market values. The American people would have been spared the delusion that they could "get rich by selling stocks to one another." If the dollar had been cut loose from gold and allowed its natural exchange rates, U. S. prices would have been free from external depressing influences.

If the U. S. Government had had the vision and the authority in 1927 to announce that it proposed to keep the U. S. power to consume in step with its power to produce by decreeing an all-round rise in wages and salaries from time to time in order to maintain the 1927 general price level firm under free competition, and if it had cut the dollar loose from *artificially fixed* exchange rates and had announced that the Treasury would assume responsibility for the dollar's exchange rates, and that all U. S. exchange transactions must be cleared through the banks designated as its agents and had ensured the *natural* exchange rates for the dollar which would have kept U. S. exports in approximate balance with imports, there would never have been any lull in the prosperity of the United States. The prosperity it was enjoying then would have been a poor imitation of the prosperity and sense of security it would have been enjoying today if the economic benefits to be derived from the higher wages had been properly utilized for preserving industrial equilibrium.

Regardless of where goods are consumed the country which produces them always furnishes the buying power for them in the long run. For many decades Great Britain produced much more than she consumed by keeping wages low and furnishing the foreign buying power for them through investing profits abroad.

That policy has proved short-sighted because the returns from her foreign investments, which can be paid only in goods, now compel Great Britain to consume materially more than she produces.

In order to give employment to their own capital and labor other countries are now anxious to produce at least the equivalent of all they consume, and therefore any worth-while equilibrium in industry is no longer possible through low wages and export trade. Great Britain can now increase her export trade only

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as she increases the home consuming power for imports. The home consuming power can be materially raised only by adopting the right wage policy.

The Transcendent Economic Importance of Wages

We are in depression because we have failed to recognize the transcendent economic importance of wages in the Machine Age.

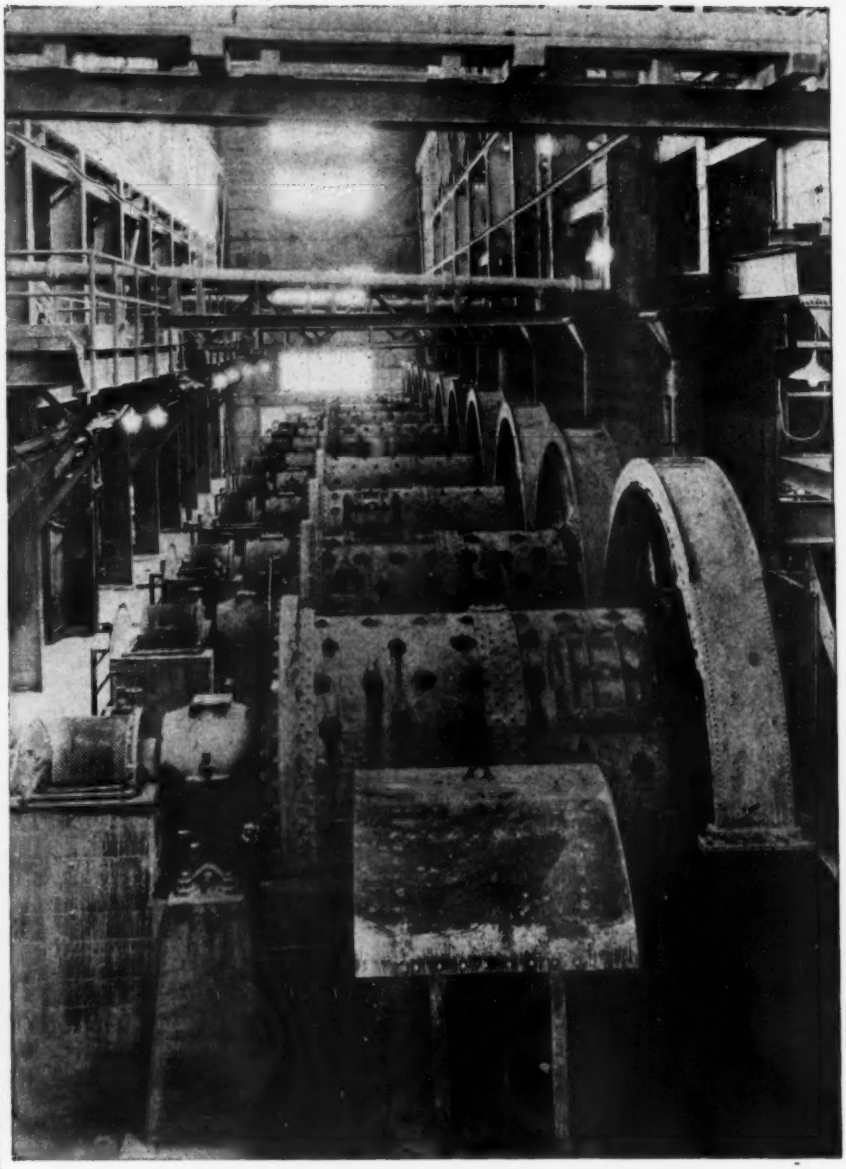
Just as labor is the foundation of all wealth, wages are the foundation of all values. Other conditions being equal, a rise in wages raises prices and a fall in wages lowers prices. *The buying power of the dollar depends upon the general wage and salary level in terms of dollars.*

Directly and indirectly, wages and salaries are the most important factor in the costs of production, also they are the most important factor in the buying power for the goods produced. If wages are not high enough consuming power falls behind productive power and prices fall.

If consumption is to be kept in step with production to the great advantage of capital as well as labor, wages and salaries—the consuming power of the consuming masses—must be raised whenever the existing claimants of the returns from industry fail to utilize its products sufficiently to prevent a recession in the general price level under free competition. For employers to lower wages and lower consuming power for each other's goods when consumption falls behind production and prices decline, is exactly the wrong procedure for success in the Machine Age.

When overproduction and falling prices become imminent the remedy is more spending for consumers' goods and/or less saving for investment in producers' goods. Higher wages and salaries would provide greater buying power for consumers' goods, and would increase the costs of production. Both effects would operate to harden prices and preserve equilibrium. Employment for capital and labor would be maintained, and thus the best interests of both would be safeguarded. Capital might have to be satisfied with lower profits for a time, thus reducing the savings available for investment in producers' goods, but lower profits for a time would be preferable to serious unemployment of capital for a longer time. The lower profits for a time, and the higher wages, would be merely the correction of the unhealthy relation between profits and wages, which had been ruling previously.

The paradox in the relation between wages and profits must be understood. The higher wages are, the greater is the demand for capital for saving labor and bringing about higher efficiency in production. Higher efficiency not only permits the opportunity for more profit, but it permits higher pay with higher consuming power for wage and salary earners under steady prices. The higher the consuming power, the greater is the opportunity for profit.



Whether depression or prosperity rules depends upon wages.

The economic forces involved in a change of the general wage and salary level are tremendous, and the instant the Government of any nation commences seriously to consider the control of those forces with a little precision by Government decrees, as the means to restore and maintain its prosperity, commodity prices, in terms of its currency would start to harden, and before any change in the wage and salary level could take place, a prosperity for that nation, which could be maintained, would be on its way.

Economic Liberty Essential to Prosperity

The forces generated by free competition have advanced us into the Machine Age, and only through free competition —economic liberty—can each worker and each capitalist find the nook in which he can best serve himself and society.

But a worse combination than economic liberty and consuming power out of step with productive power cannot be imagined. Such a combination leads to lower and lower prices and lower and lower employment if no artificial restraining measure is effected.

When we get into a vicious circle of falling commodity prices and reduced spending under free competition, it cannot stop of its own accord.

In the previous depressions the link of the currency unit with gold was the artificial measure effective in preventing a complete collapse in prices and employment, but not without bankruptcy and unemployment and much suffering. Prices and wages were pushed down until the prices of the country in distress attracted buying in countries not suffer-

ing from depression. Such buying gave confidence that the bottom had been touched and that prices would tend to rise, and that better trade could be anticipated.

In the present depression the gold standard had been so wrecked by international investments, war debts, doles, inflexible wage rates, and tariffs, that it was no longer effective in preventing a collapse of prices and employment. So the expedient of curbing economic liberty was resorted to. Price-fixing, restricting output, marketing boards, codes, etc., have become the fashion. But competition is the life of trade. When trade is deprived of its energizing force, the incentive for a manufacturer to invest in more and better tools, and thus give employment to capital and labor in the production of producers' goods, is greatly reduced if he cannot underbid his competitors in order to maintain or increase his volume of production. Consequently his opportunity to satisfy his need for more profit is confined mainly to working his employes harder and reducing employment, or reducing their wages, either of which reduces buying power.

To interfere with economic liberty stabilizes inefficiency, weakens the attraction between idle capital and idle labor, continues unemployment for both and the need for doles for both, and brings the need for bureaucratic control of industry. Endless responsibilities fall upon the Government, which for the best interests of all concerned, would a thousand times better be left to the free operation of supply and demand if the Government would merely assume responsibility for enabling demand on the whole to keep step with supply.

Instead of interfering with economic liberty to prevent the evils of free competition when consuming power is out of balance with productive power the Government should merely concern itself with restoring the balance. This is the simple change which must be effected in our economy if we are to enjoy the benefits possible to all in the Machine Age. The Government should concern itself with the cause of the disequilibrium, not with the countless effects.

A better economic combination than economic liberty and consuming power in step with productive power is impossible. Only through free competition can there be the strong natural attraction between labor and capital that will ensure useful employment for all who desire it.

Prices Must Be Raised—Debtors the Driving Force in Commerce

Whenever prices have ruled at a certain level for some time as they did during the War, and in the Twenties, and then fall materially below that level, prosperity cannot be restored in any reasonable time without restoring the former general price level.

Low prices seriously burden debtors who are the driving force in commerce and industry. Debtors are the planners and directors of the employment for savings. When prices fall interest and repayment charges on loans and fixed interest securities continue at their face value and thus take a greater percentage toll on the selling prices of goods. This with the fact that the volume of production often declines, causes debtors further serious difficulty in servicing their former obligations. They are unable to make use of further savings, and a glut of savings for which there is not profitable employment is the natural result.

It is most important *economically* that prices be raised so that debtors may be relieved from the unsound burden of their former obligations and thus be enabled to fulfill their vitally important function in commerce and industry of giving profitable employment to the accumulated savings.

Restoring the former general price level is the only POSSIBLE means of achieving prosperity in any reasonable time.

Prices cannot be restored without increasing the demand for goods or increasing the costs of production. Then why not kill two birds with one stone by raising all wages and salaries?

The raising of wages at the right time cannot be left to employers acting independently. *All must raise wages together to avoid individual injury and to derive collective benefits.* The "dispute method" of adjusting wages is too haphazard and unscientific for any success in the Machine Age and it must give way to the correct control over the general wage and salary level for the best interests of all concerned. To give the Government control over the general wage and salary level would only be *giving it control over the buying power of the dollar by the only possible means,* which is surely a Government responsibility.

Success Is Impossible Under the "Dispute Method" of Adjusting Wages—A Wages Board Required

If we are to enjoy the tremendous advantages possible to all in the Machine Age we must become accustomed to the authority of a "Wages Board."

An employer and his employes are not competent to determine by the "dispute method" even the wages which should be paid for their own best interests, to say nothing of the vital interests of all the other employers and their employes.

The "dispute method" of adjusting wages prevents justice between labor and capital, between employer and employer, and between craft and craft. If the curse of constant strife about wages is to continue, what is to be the end?

The "dispute method" of adjusting wages is quite as ill-suited to the needs of the Machine Age as the ox cart, and should have been discarded with it.

The old system of haphazard wage adjustments with a constant conflict of interests and turmoil must give way to a system that will permit the maximum possible return to both labor and capital, and thus render their interests mutual.

Only a wages board armed with the facts and figures pertaining to the balance betweeen consumption and production, the tendencies in wholesale prices, and the relative demand for labor in the various crafts and in the various districts of the nation, can be trusted with jurisdiction over *the most vital economic factor* in the welfare of all.

There is a wage rate in each case which is best for all concerned, and employers and employes must recognize the tremendous mutual advantages to be gained through allowing a Government agency to consider all the factors involved and to determine that rate in harmony with the law of supply and demand in all major wage adjustments.

If prosperity is to rule the old claptrap about a "fair wage" or a "living wage" and a "fair return for capital" must cease. We must have wages and salaries on a scale that will keep consumption in step with production. Wages and salaries must be paid on a scale that will stabilize the buying power of the dollar at an equitable price level under free competition. Capital is entitled to all it can get under that condition, and only under that condition can it derive its maximum reward in the long run.

With proper facilities for collecting the pertinent data a case for a partial or general rise in wages and salaries would become very apparent to all in a little while, and only mediocre ability would be required for satisfactorily administering the wages board.

A steady general price level would become such a clear and logical index to which wages should always be adjusted that the man in the street would soon never question its infallible fairness to all.

The degree of justice and intelligence used by the Government in the exercise of control over the general price level would become so plainly discernible to all that there would never be any opportunity for the misuse of that power.

At first the wages board would decree rises in all wages, and salaries in the lower brackets, by the same flat percentage until the 1928 general price level was restored or until labor and capital became comfortably employed. Later as volume production and the use of better methods tended to lower prices, *as they always do under free competition,* the wages board would decree rises to each craft or each district of the nation in harmony with the law of supply and demand, allowing rises in cases where there tended to be a shortage of workers and withholding rises in cases where there tended to be a surplus.

No rises in wage rates would be permitted while there was any tendency towards a rise in the general price level established as the standard. A rise in the general price level could not proceed far, and prices in general would soon recede if the general wage and salary level were held stationary under free competition.

Advance notices would always be given for rises in wages, and in raising the general wage and salary level to raise the general price level and bring prosperity, the prospect of greater consuming power and a higher labor cost in many cases, would cause prices to ad-

vance sharply before rises in wages would be effected and thus higher profits would accompany higher wages.

The prospect of greater consuming power and higher prices would stimulate employment for labor and capital in the production of more producers' goods.

Higher prices would reduce the unsound burden of private debts incurred under higher price levels, and similarly the burden of the public debt would be reduced and prosperity would widen the spread for the tax burden. Full employment and relief from supporting the officially unemployed, and the many others who are being supported, or partly supported, by relatives, etc., but who would prefer to be self-supporting and enjoy a much higher consuming power, would add materially to the total consuming power. Through volume production and the use of better methods the amount of labor required per unit of production would fall. This would leave room for higher wages and higher profits under steady prices at the higher level. With all the benefits mentioned, the buying power of wages and profits would be materially increased, and the higher consuming power thus attained would be freely translated into full employment for all the available labor and capital under free competition.

In a word, higher prices are required to bring about the full employment of capital and labor. Obviously, profits and wages can be greatest when unemployment is least.

Wages and salaries must be paid on a scale that will keep consuming power in step with productive power for the best interests of employers as well as the employed. A steady general price level—*a steady buying power of the dollar—is the infallible index* to which rises in wages should always be made after prosperity is achieved. In the best interests of all, and particularly to avoid the economic consequences of distress to debtors, the benefits of volume production and the use of better methods must be reflected in a higher general wage and salary level, not in a lower general price level.

With benefits from better efficiency being translated freely into higher wages and salaries, employes would become just as zealous for better efficiency as employers and their interests would be rendered mutual in fact as well as in theory.

For success in the Machine Age the buying power of the currency unit must be stable. Its buying power must be so regulated that it will always buy, in wholesale markets, the same amount of all the standardized commodities consumed in the country each being weighted in proportion to the total amount consumed. Its buying power must be regulated to a scientifically constructed index of value. This can be achieved only through the control of the general wage and salary level.

A wages board should have control of the wages and salaries say under $4,000 per year paid by all important employers, say those employing 20 people or more. The wage rates paid by the larger employes would soon automatically set the rates which those employing under 20 workers would have to pay.

All employers could be left free to make whatever adjustments they saw fit in the pay of their employes getting over $4,000 per year. Large employers could also have similar discretion over the pay of say 2 percent of their lower paid employes in a 12 months' period, and smaller employers could be allowed a higher percentage. Under the chronic shortage of labor which would constantly rule such freedom would result mainly in rises to a few employes.

In a country like the U. S. there should be a national wages board, and in each state local wages boards cooperating with the central body to consider all proposals for changes in wage rates. The authority of the national board, it may be argued, would infringe state rights. But the control of the buying power of the dollar is a National responsibility, and if it is to be properly performed the central Government must have control over the factors which determine the buying power of its currency unit throughout the area using it.

If the people of any country are ever *right* in thinking that for the best interests of all concerned their country is too large to allow the central Government to have final discretion over all the factors which determine the buying power of its currency unit and the balance between the consuming power and productive power of the country as a whole, then that country is too large for one central government and one currency system in the Machine Age.

Fixed Exchange Rates Wrong—Tariffs Wrong

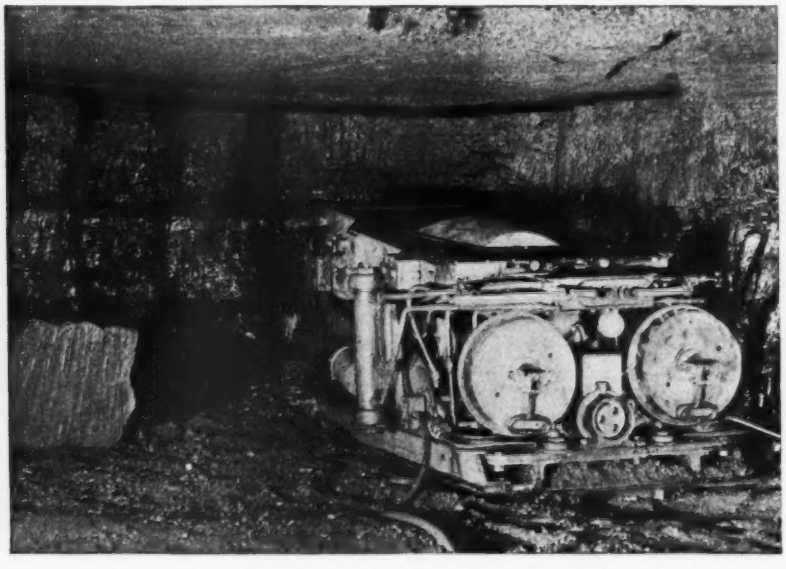
The Government has another responsibility to its currency unit, viz., its exchange rates. The idea that the dollar for instance should have *fixed* exchange rates with other currencies is the most damaging of all our orthodox economic fallacies. The orthodox exchange method which puts the internal price level and the health of American industry at the mercy of external caprice or blunder should have been discarded with the ox cart also.

The internal buying power of the dollar should be stable at the level which is fair to debtors, public and private, and their creditors, and which will enable capital and labor to be always in demand. The exchange rate of the dollar should be flexible so as to keep American exports in balance with imports under free trade, and thus prevent any harmful influence of wages or prices elsewhere upon the correct American internal general price level and upon the American worker's standard of living.

The dollar's exchange rates while flexible should be as stable as possible. The maximum degree of stability could be attained only if all exchange transactions were forced to clear through one organization preferably supervised by the Government in which many of the banks would act as agents, and if speculation in the dollar's exchange rates and "the flight to" and "from the dollar" were stopped. To frown at gambling in lotteries, sweepstakes, etc., and then permit the dollar's exchange rates to be a plaything of international speculators is straining at a gnat. No facility should be afforded in the United States for such harmful practices.

The dollar's exchange rates should rest upon its buying power in U. S. Markets. Then when the U. S. moved to a higher internal price level to achieve prosperity, the dollar's exchange rates would be correspondingly lowered so that the prices of U. S. goods to foreigners and the relative amounts of U. S. goods required to purchase the desired goods and materials from abroad would not change.

The highest standard of living can be enjoyed only under free trade so that



Floor Type Coal Saw Shown During the Actual Preparation of a Coal Face

goods costing less to produce can be exchanged freely for foreign goods which would cost more to produce, wherever possible.

Tariffs constitute a one-sided departure from the nominal exchange rate of our currency unit. They make it more difficult for us to buy foreign goods, but they do not make it easier for foreigners to buy our goods. A lower exchange rate of our currency unit would act on both sides of our trade account, decreasing the buying power of our money for foreign goods, but increasing the buying power of the foreigner's money for our goods.

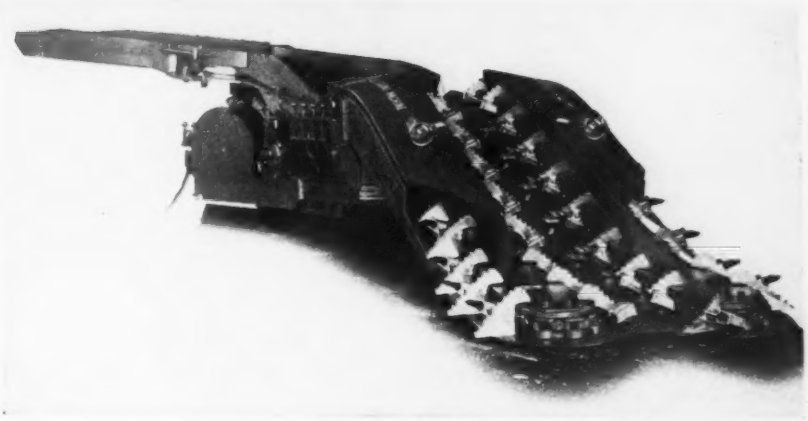
If an average of 20 percent tariff duties is required to keep U. S. payments abroad in balance with payments received from abroad, then the removal of all U. S. tariffs and a 10 percent reduction in the dollar's exchange rates would reduce the cost of U. S. goods to foreign consumers 10 percent and reduce the cost of foreign goods to U. S. consumers 10 percent. The increased imports attained through lower prices for foreign goods would be offset by a corresponding increase in exports.

A reduction in the dollar's exchange rates of 10 percent which was accompanied by a removal of 20 percent in U. S. tariff duties would work only to the mutual benefit of all the countries concerned and the other countries would soon see that a similar policy on their part would effect further corresponding mutual benefits for themselves and the U. S. To bring about free trade, *tariffs must be discarded.* To use tariffs as a bargaining lever for unsound preferential trade agreements as many statesmen have been advocating, is exactly the wrong way to bring about free trade. All should buy in the lowest market and sell in the highest in the best interests of the standard of living in their own country as well as that of the rest of the world.

The advantages of international trade to a country "are far above the petty interests of this industry or that industry," in the words of Mr. Cordell Hull. "The slogan, 'Buy at Home'" is fallacious because it "really means, *Don't Sell Abroad,*" but without a sound exchange policy much foreign trade leads to foreign loans and proves a snare and a delusion.

The conduct of dollar exchange in the manner proposed would quickly lead to the formation of an International Clearing House Association, through which the Treasury of each country would in effect pay its exporters for the goods exported and its importers would pay the Treasury for the goods imported. The exports and imports of each country would be kept in the proper balance by stabilizing the natural exchange rates of its currency unit. Because an International Clearing House Association would prove the ideal for the purpose from every angle, including the settlement of the War debts, it is bound to function as the future international exchange mechanism.

The way to lasting world peace is through an exchange system that will permit prosperity and the great mutual advantages of free trade. Then territorial expansion would prove an economic handicap rather than an advantage to the people of every nation.



Jeffrey L-400 Loader

To enjoy prosperity under the gold standard, a country must have a plentiful supply of gold. This causes an unsound and pernicious international rivalry for foreign trade and gold. The God of War himself could not have contrived for the world, a monetary and exchange system better suited to his purposes than the gold standard.

Orthodox Theory for Controlling Prices Is Fallacious

There has been a deep-seated belief in the quantity theory of money for controlling prices. A large volume of bank credit outstanding permits, and is an *effect* of, prosperity, but not the *cause.* Freedom for the expansion of bank credit permitted the industrial activities necessary to the prosecution of the War, and is an essential to achieving and maintaining prosperity.

The dollar lost buying power during the War, not because of the greater volume of bank credit outstanding, but because wages were raised. The buying power of wages improved during the War. The benefits of better efficiency and volume production more than offset the effects of higher wages, from which it follows that if wage rates had remained stationary during the War the dollar would have had a higher buying power at the end of the War than at the beginning.

The purchase of securities by the central bank, in order to raise the prices by expanding the volume of currency and/or bank credit outstanding, which is advocated in some quarters, only adds to the glut of money in the hands of savers for which there can be no profitable employment until there is more money in the hands of spenders.

Raising the central bank rediscount rate and contracting the volume of currency and central bank credit outstanding in order to lower prices, can stampede debtors into sacrificing the prices of goods in order to liquidate their debts, but that method can be successfully used to lower prices to any great extent only if the workers will accept lower wages. In the many decades preceding the War, Great Britain was successful in maintaining the gold standard, but with periods of very serious unemployment and suffering, through the power of the Bank of England to keep British wages and prices sufficiently low to ensure a favorable balance in trade.

With the inauguration of the dole, however, unemployment no longer compelled British workers to accept lower wages or starve. For that fundamental reason the Bank was unable to force the British price level down sufficiently as in former times, and was forced off the gold standard in 1931. The strength of the labor unions similarly interferes with the power of the Federal Reserve Banks to reduce prices by the *hunger method,* and in an enlightened age the policy of deflation will never be pursued. Because of the passing of the conditions favorable to the operation, the gold standard with its inherent ups and downs of trade cycles cannot be successfully restored.

The general wage and salary level determines the general price level. The buying power of the dollar can be held stable at any desired level only through the control of the general wage and salary level. To attempt to control it in any other way is on a par with trying to make the tail wag the dog.

As long as the Government refrains from paying its obligations by the printing press method, there need never be any fear of the buying power of the dollar being inconsistent with the wage level under free competition, regardless of how little or how much gold or silver the dollar will buy. Gold and silver have high values now through the fancy monopoly prices monetary authorities pay for them because of the lack of an exchange system in keeping with the needs of the Machine Age.

The cure for the present trouble is not tinkering with the banking and money system, but dealing directly with the cause of the disequilibrium between consuming power and productive power. The banks would never be confronted with general deflation under a sound economy

and there should be no restriction on the volume of central bank credit and currency available to sound banks against their sound short term collateral.

There need be no fear of the banks not being able always to accommodate the sound needs of commerce and industry with currency and bank credit or of harm from their extending bank credit to all whom they consider credit-worthy, when the Government relieves the banks of all responsibility over the buying power and the exchange rates of the dollar.

Reverence for inflexible exchange rates and the quantity theory of money for controlling prices is orthodox fog which must be cleared away before any worthwhile prosperity is possible.

The Farm Problem

Far too many workers have been driven into trying to eke out a living on the land. The present farm problem will be solved only by a demand in the other industries for a host of workers now on the land. Health in the other industries would soon bring health to the farming industry with higher prices and need for farm workers at higher wages, and need for labor saving facilities.

That "the buying power of the *farm population* must be raised relative to that of the urban population," is claptrap. Only by *reducing* the population on the farms and mechanizing farm work, will the standard of living on the farms be raised.

Shorter Working Time

Shorter working hours would distribute the present work among more workers and would reduce the number of the totally unemployed by increasing the number of the partially employed. If the hours of the workers are shortened the workers must produce less. If they produce less they must consume less. Is there a worker anywhere who wishes to produce less with a corresponding reduction in his consuming power? Workers should not be asked to produce less while their desire for higher standards of living remains unsatisfied.

The consuming power the workers desire should determine the weekly working hours. Shorter working time increases the capital charges on output in many industries. The fact that there is now an oversupply of workers is not the cause of the depression, and reducing the consuming power of the workers employed is not the cure.

Old Age and Disability Pensions

There can be full employment for all labor and capital only if all the money yield from industry is returned again through spending for consumers' goods or investing in producers' goods.

Spending is quite as important as saving to the equilibrium of commerce and industry and to the advance to higher standards of living.

In order to keep the wheels of industry turning it is important that the workers be afforded security for the time when they are unfit for employment, so that they may feel free to enjoy a good standard of living during their working years. The cost of taking care of old or disabled workers is logically a charge to the labor costs of production and should be reflected in the general price level. Such reflection would have no effect upon the cost of American goods to foreign buyers under the correct exchange policy. The payment of old age and disability benefits is logically a Government obligation and therefore the Government should raise the funds for such benefits by levying a small tax on all pay rolls.

Government Spending

Many advocate lavish Government spending as a means for restoring prosperity, but, economically, such spending constitutes nothing more or less in the main than *a dole at high wages and salaries* to many who would otherwise be listed as unemployed.

Why waste capital in unnecessary Government projects, and thus increase the burden of public debt which is already much too heavy?

To try to prime the pump for more spending by any means other than the assured prospect of the *direct* means—higher prices and higher wages and salaries—can result only in piling up unnecessary handicaps for the future.

Unfortunately the present U. S. "dole" is being paid in the main out of borrowings instead out of income, and a debt is piling up which must be paid by producers later, and which will correspondingly reduce their consuming power later. The "dole" is so large that to pay it out of taxes would be practically impossible. Even though such outgo were fully covered by current income, the consuming power of the employed and the capitalists, especially the smaller capitalists, would be materially reduced by their outlay for taxes. Furthermore, the taxes paid by those having larger incomes would reduce the capital which has been saved and which should be finding profitable employment in providing more efficient means of production and thus raising the standard of living of the American people instead of providing a "dole" for them.

The unemployed and those on the Government "dole" should be producing the goods and services they now so urgently desire, and they would be producing them under the correct economy, which would treat the cause of the disequilibrium out in the open where all could comprehend the end desired and the soundness of the means used for achieving it.

Government Responsibility to Industry

The Government control of industry with a view to controlling output and prices, is to thwart the operation of the laws of supply and demand and the survival of the fittest, and leads into deeper and deeper water, and the seeming need for many more complicated Government responsibilities.

Under price fixing and the allocation of production it is impossible to tell where a just profit ends and graft begins.

Capitalism without competition ceases to be capitalism and becomes privilege, and a worse "ism" for the affliction of society can scarcely be imagined.

If we want Government ownership, bureaucratic control of industry, and regimentation, instead of economic liberty, then interfering with free competition is the surest road to that end.

Consumption should be kept in step with production. The untold possibilities of the Machine Age should be enjoyed to the full. Everyone should be ensured a standard of living in keeping with his ability and desire to produce. The Government has most important obligations, but curbing economic liberty is exactly the wrong road to the ends desired.

The Government should be charged with responsibility for the following:

(a) Maintaining the internal buying power of the dollar at the 1928 level *by the only possible means*—control of the general wage and salary level. The "dispute method" of adjusting wages is too crude for any success in the Machine Age.

(b) Regulating the exchange rates of the currency unit so that exports plus foreign incomes will be kept in balance with imports under free trade.

(c) Enforcing free competition, which is the life of trade, and,

(d) Paying old age and disability pensions through a small tax on all pay rolls.

With economic liberty ruling subject to the Government fulfilling its above logical obligations all need for the numberless unsound interferences with commerce and industry which seem necessary under the present hodgepodge economy would then quickly disappear.

Wages and salaries always on a scale that will maintain the 1928 *general price level firm under free competition is the simple requirement for lasting prosperity.*

If the President could become interested in convening Congress for the announced purpose of considering:

Firstly, the abolishment of the "dispute method" of adjusting wages.

Secondly, the control of the buying power of the dollar, under free competition, through the businesslike control of the general wage and salary level, and,

Thirdly, a commonsense management of the exchange rates of the dollar.

Then no matter how quickly the President acted, prices would harden *before Congress could be convened*, and you of the Mining Industry, and the leaders of all other industries, would be laying plans for improving and enlarging your facilities of production.

Before the *First Government Decree* for a rise in wages and salaries could become effective, depression and want in the midst of plenty would have become a pestilence of the past. Prices would be up; profits would be rolling in; and full employment for labor and capital at healthy wages and profits would be ensured to the end of time.

Of All Things . . .

After all, the New Dealers do save money. . . . They only tossed away $12,000,000 on the Florida canal and 'Quoddy projects which were originally scheduled to cost $250,000,000. . . . There's a clear saving of $238,000,000! . . .

Every time you take a breath the Government spends $712. . . . And it won't do you any good to hold your breath. . . . it'll still be $712. . . .

Nira, Iowa, the little town discovered when the NRA was born and where the first NRA stamps were sold, hasn't been helped any by the NRA. . . . The railroad running through there has sold its depot and closed up shop. . . . Its oldest resident said: "We got along before we had a depot and we got along before NRA."

The latest New Deal project hasn't become widely known yet. . . . It's T.R.A.P. . . . stands for Treasury Regional Arts Project . . . and is in addition to Harry Hopkin's WPA and Harold Ickes PWA art projects. . . . One object of TRAP . . . to send indigent water color artists to the Virgin Islands to paint and make their living there. . . . Living is cheap down there. . . . Shouldn't cost more than $1,000,000 to put this one over. . . .

Senator Carter Glass says he has never cast a vote which he would withdraw or for which he would apologize. . . . Wonder how many more Senators could say the same. . . . Incidentally the Virginian voted against the 1936 tax bill. . . .

The arrival of the *Queen Mary* reminds us of something. . . . When the first Cunarder came here in 1840 we were a Nation of 17,000,000 people and we had a public debt of 21 cents per capita. . . . Now we have 125,000,000 people and the national debt is nearly $300 per person. . . . An increase of seven times in our population and 1,500 times in our debt. . . . That's progress! . . .

Newspapermen, worried about spendthrift use of the alphabet told President Roosevelt about APTOHE and SPLWEBGTOHE (Association for the Prevention of Taking Off Hats in Elevators and Society for the Protection of Ladies Whose Eyes Have Been Blacked by Gentlemen Taking Off Hats in Elevators). . . . He laughingly remarked that the whole business would have to be put under Government regulation. . . . It's about the only thing left not under Government regulation. . . .

Who said the taxpayers don't pay for political campaigns. . . . The last two months the Appendix to the *Congressional Record* . . . where all the franked political speeches come from . . . has been thicker than the *Record* itself. . . . And it costs $50 a page to print. . . .

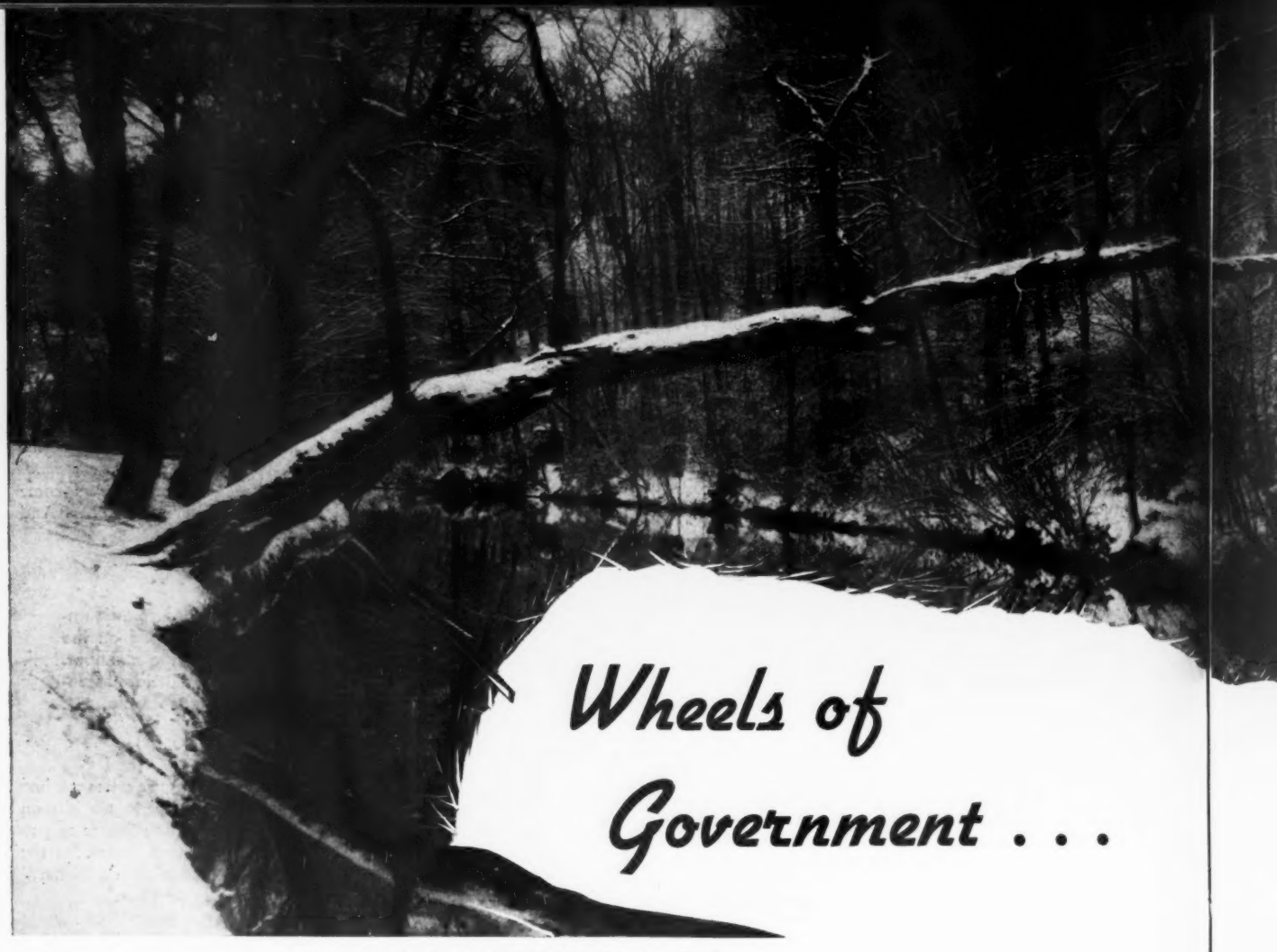
American politics. . . . The night before adjournment, important legislation being debated on the floor, a bare handful of Senators in the chamber. . . . . . Where were the rest? . . . Oh, outside, listening to the Schmeling-Louis fight on the radio. . . .

Senator Borah, who was something of a figure when we had national prohibition, isn't above joshing about the demon rum now and then. . . . A bill was up in the Senate to pay a Government lawyer $1,000 for having been struck on the head by a whiskey keg during a moonshine raid. . . . "What," asked Senator Borah, "happened to the liquor?" . . .

The new tax bill is to soak the rich, they say. . . . Seems likely they ought to find a few to soak first. . . .

A farmer in North Dakota refused to move from his farm to a new place selected for him by the Government. . . . He can't do that . . . Rex Tugwell's Resettlement says he's breaking the law. . . . But the school children still sing . . . "My Country 'Tis of Thee . . . Sweet Land of Liberty!" . . .

The big question bothering the Federal Trade Commission right now is it Lagoona or only Loofah. . . . It is investigating a firm which sells sponges advertised as "Lagoona" coming from warm Southern Pacific waters and good for the health because treated with violet ray. . . . The FTC says that's all poppycock, that the sponge is not a sponge but is a vegetable called loofah resembling a gourd grown on land . . . Washington is anxiously awaiting the decision due this month. . . .



Wheels of Government . . .

Rock Creek Park, Washington, D. C.

SENATOR KEY PITTMAN from the mining State of Nevada, was in the chair when the adjournment resolution made by Majority Leader Robinson, of Arkansas, put an end to the 74th session of the National Congress, at midnight, June 20. The adjournment was marked by a filibuster conducted against the enactment of the substitute Guffey Coal bill. The youngest Senator, Rush Holt, of West Virginia, bore the brunt of the filibuster and was on his feet when Senator Robinson rose. Lacking the experience of older heads in parliamentary procedure in the Senate, the young filibusterer was extremely cautious in yielding for the motion. Said Senator Robinson, "When you hear what this motion is, you will not want the floor any longer."

The real cause of delay and the measure which extended this session of the Congress many weeks beyond its anticipated life was the Revenue Act of 1936. This measure, prompted by the President's message of March 3, required prolonged study on the part of a subcommittee of the Committee on Ways and Means. The report of the subcommittee was followed by eight days of hearings before the full committee, ending on April 8. Thereafter, the Committee labored until April 21, when a bill was reported which followed the desire expressed in the President's message, in that it eliminated the existing normal taxes on corporations and levied taxes as high as 42½ percent on their undistributed earnings. The House of Representatives, after five days of more or less perfunctory debate, passed the bill without any important change.

Sentiment in the Senate, when the Revenue bill was received by the Committee on Finance, was definitely against the measure. The Senators realized that the bill as written was a prohibitive drag on business enterprise and expansion. The hearings before the Committee on Finance were much more thorough and comprehensive than those before the Committee on Ways and Means. At times the majority of the committee members were reported to be in open revolt against the principles of the bill, and consequently against the desires of the Administration. In the redrafted measure reported by the Committee on Finance and passed by the Senate, the normal corporation income taxes were restored and the rates increased to a maximum of 18 percent. The tax on undistributed earnings was lowered to a flat 7 percent.

After passing the Senate on June 5, the Revenue Act remained in an extremely controversial position in the Conference Committee until June 18, when a compromise was finally reported to be promptly accepted by the House on June 19, and by the Senate on June 20. The President's signature on June 22 placed the measure definitely on the statute books.

The Revenue Act of 1936 thus supplants the Act of 1935, which never had a chance to become operative. It places a tax on corporate income at the following rates: Eight percent on the first $2,000 of adjusted net income; 11 percent on the next $13,000; 13 percent on the next $25,000; and 15 percent on all in excess of $40,000. In addition, a graduated tax on that portion of adjusted net income (after deduction of normal tax) which is not distributed in dividends; at the following rates: 7 percent on the first 10 percent; 12 percent on the next 10 percent; 17 percent on the next 20 percent; 22 percent on the next 20 percent; and 27 percent on the final 40 percent. Dividends to individuals are taxed as part of their private incomes with no exemptions. Exemptions from the undistributed profits tax are provided for banks, insurance companies, corporations in receivership, and corporations under contracts which prevent payment of dividends. The exemption of

inter-company dividends from normal tax is reduced from 90 percent to 85 percent. The capital stock tax rate is set at $1 per $1,000 of valuation and the excess profits tax is continued; a new declaration of value may be made for the purpose of computing these taxes.

Following the nullification of the Guffey Act by the Supreme Court, there was a renewed demand on the part of the representatives of labor for enactment of further legislation. Within 48 hours after the Supreme Court ruling, Senator Guffey, of Pennsylvania, had introduced his new Guffey bill, accompanied by an identical measure in the House of Representatives by Fred Vinson, of Kentucky. The new Guffey bill, while quite similar to the original Act, eliminated the labor provisions. It provided an increase in the National Bituminous Coal Commission from 5 to 7 members. Of these, two were to be from the producers of bituminous coal, two from the workers, and three were to be impartial men representing the Federal Government. The life of the Act, as the bill was amended preparatory to passage in the House, was limited to two years. The United Mine Workers of America gave its unqualified support to the enactment of the measure because of the belief of its leaders that the fixing of bituminous coal prices would permit maintenance of the wage structure which they desire in all parts of the country. Its officers express the belief that unless there is stabilization of coal prices there will be price cutting and a demoralized market, resulting in wage cuts on the part of coal producers in distress.

Another labor measure which came to life largely as the result of the Supreme Court decision in the Guffey case was the Walsh Government Contracts Bill, which on April 29 had been tabled by the House Committee on the Judiciary by a vote of 11 to 7. The bill had originally passed the Senate on August 12, 1935. Rewritten several times by the House Judiciary Committee, it was reported on June 5, passed the House June 18, and in its rewritten form received the final approval of the Senate on June 20. As passed, the measure applies to contracts above $10,000. The contractor must stipulate that he is the manufacturer or regular dealer in the materials used in the contract performance; that his employees are paid not less than a minimum wage as determined by the Secretary of Labor to be the prevailing wage in the particular area for that work; that a maximum of an eight-hour day and 40-hour week is observed; that no one under 18 years of age and no convict labor is employed; that proper working conditions, sanitary and safety conditions are observed—compliance with state laws to be prima facie evidence of such observance. At the discretion of the Secretary of Labor, exemptions may be granted from the maximum hour provisions with an allowance of time and one-half for overtime.

A bill by Senator Byrnes, of South Carolina, which passed the Senate August 22, 1935, was spurred into action at the behest of labor interests, passed the House on June 19, 1936, and was sent to the President. It provides a fine of $5,000 and two years' imprisonment for transportation in interstate or foreign commerce of persons who are to be employed "to obstruct or interfere with" the procedure of picketing during labor controversies.

Senator LaFollette, of Wisconsin, secured the enactment of his resolution providing for an investigation by a Senate Committee, at various points in the United States, of the practices surrounding the use of special agents in labor controversies. The sum of $15,000 is provided for the expenses of the investigation and the subcommittee named consists of Senator LaFollette, chairman; Thomas (Dem., Utah); and Murphy (Dem., Iowa). Testimony at the hearings on the resolution brought forth the allegations that "labor spies" were used to break up efforts to organize trade unions in industrial operation.

Senator Black's six-hour day and five-day week bill and the companion Connery bill, reported by the House Labor Committee on July 18, 1935, remained on the calendar of the two houses without further action. Representative Connery (Dem., Mass.), stated several times in the course of the session of Congress that his bill was the answer to the unemployment situation, and that he confidently anticipates the enactment of such a measure in 1937.

Among the many measures of the 74th Congress introduced for the purpose of regulating industry there may be named, in addition to those cited above, the Patman-Robinson-Borah-Van Nuys bill prohibiting discrimination in price between purchasers; the Wheeler Anti-Basing Point Act; the O'Mahoney Business and Corporation Licensing bill; the Wheeler bill permitting the Federal Trade Commission to initiate investigations of business concerns; the Ramsay (Dem., W. Va.) bill for state compacts to stabilize the coal industry; Lea (Dem., Calif.), the Natural Gas Act; Ellenbogen (Dem., Pa.), the National Textile Act, and the Wood (Dem., Mo.), bill for stabilization of the structural steel industry. Of this group the Patman Price Discrimination bill, approved by the President June 19, was the only measure enacted into law. As finally passed, it was a very much involved piece of legislation and legal analyists are not, as yet, agreed as to its interpretation or as to its probable results. It is generally agreed that it will require a number of court decisions to clarify its meaning and application.

Briefly, this law amends section 2 of the Clayton Act with reference to discrimination in price in interstate commerce. It limits quantity price differentials to those which make "only due allowance for differences in the cost of manufacture, sale, or delivery resulting from the differing methods or quantities in which such commodities are to such purchasers sold or delivered." Under the law the Federal Trade Commission may establish quantity limits above which price differentials are not permitted.

While a stream pollution bill was introduced in the first session of the 74th Congress by Chairman Mansfield (Dem., Texas), of the Committee on Rivers and Harbors, no action resulted and it was not until Senator Lonergan (Dem., Conn.), pressed for action in the second session on his two bills, that many of the industries affected were awakened to the necessity of making their viewpoint known before the Senate Committee on Commerce. The Lonergan bills conferred enforcement powers upon the National Resources Committee, and provided for the division of the country into sanitary districts and the setting up of "standards of purity" for the waters of each district.

It was known at the time of the hearings on the Lonergan bills that the administrative departments of the Government were not in sympathy with the enactment of water pollution legislation during the existing session of Congress. Additional bills, however, introduced by Senators Barkley and Copeland, and by Representative Vinson (Dem., Ky.), providing for a Division of Stream Pollution Control in the Bureau of Public Health Service, without enforcement powers, met with the approval of the Administrative departments and were pressed for enactment. Two of these bills, the Barkley and Vinson bills, would in all probability have been enacted had not Senator Lonergan objected by moving for a reconsideration of the vote in the Senate. Senator Lonergan's position was that he had not thought possible the enactment of his bills in the Seventy-fourth Congress, and he felt that consideration of the subject should go over to next year.

Undoubtedly many of the measures which failed of passage will be introduced in the next session of the Congress. There is also among the membership of the present Congress a definite thought on the part of many that amendments to the Constitution will receive early consideration with a view to permitting regulation of industry which will be upheld by the Supreme Court.

IMPORTANCE OF MACHINERY IN MODERN MINING . . .

Presented by

ROBERT W. GILLISPIE, President
Jeffrey Manufacturing Company

CLARENCE B. RANDALL, Vice President
Inland Steel Company

F. A. MERRICK, President
Westinghouse Electric and Manufacturing Co.

HENRY S. BEAL, President
Sullivan Machinery Company

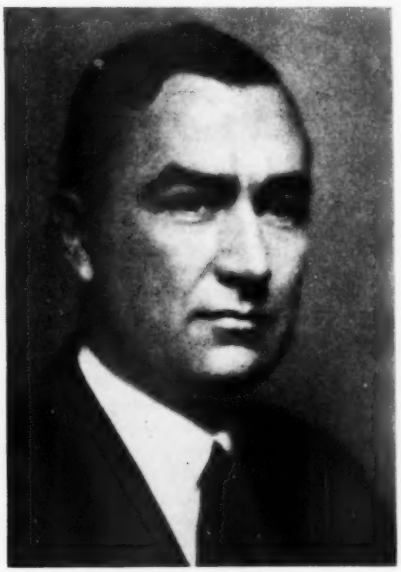
WILLIAM E. GOODMAN, Vice President
Goodman Manufacturing Company

W. E. BARROW, President
Joy Manufacturing Company

J. FURLONG, Manager, Mining Department
Allis-Chalmers Manufacturing Company

IN PARTNERSHIP—The Producer and the Manufacturer

IT IS well for all of us at times to pause from the headlong activity and striving of life, take inventory and set a sight on the true goal of our labors. Only then do we appreciate to the fullest that, whether individually we be in professional service, agriculture, mining, or manufacturing, the labors of all are directed primarily toward a higher standard of living. To achieve this in today's



Robert W. Gillispie

intricately organized society there must be a high degree of dependence of one upon the other. It is only thus that the production of goods and services can be stimulated, the only way that true wealth is grown.

For the best, there can be no cleavage between different pursuits and services, nor any vital disagreement in viewpoint between individuals closely allied in interests. If then we should all be strug-

gling to obtain a certain one objective, each in his own sphere contributing his part, an increasing realization of partnership ought to come to us in place of differences and antagonisms among individuals or groups.

Applying this philosophy more specifically, the coal industry is much more than an organization of mining companies with their producing and marketing facilities. In close affiliation is the manufacturer who supplies the mining tools with which the producer works. The two function in a partnership to serve a third party, the coal consumer. Their respective responsibilities converge to the common task of placing a more desirable fuel at the disposal of more and more people for their increased comfort and welfare.

The business requirements of these two partners follow parallel lines. In opening a mine the coal producer has to have faith in the continuance of his markets and physical conditions as forecast, and must evidence that faith by a substantial capital investment from which no return may be expected for a long period. Similarly, the manufacturer of mining equipment must manifest courage of conviction by making large investments in the design and development of machinery, knowing full well that any return will be well in the future.

Both parties have a hand in the selection of the necessary machinery for mining and the experience of each is applied to its design, installation and operation. The judgment of the manufacturer is based on wide knowledge of method and applications at many mines, supplemented by research and extensive tests. That of the operator is derived from experience and accurate knowledge of local conditions and market requirements. Only by the free interchange of ideas and information can these two partners develop means for most effectively reaching their common objective.

The manufacturer's first task, obviously, is to anticipate the producer's needs or, failing in this, be prepared to meet the needs shortly after they arise, whether they be for equipment that is safer, more economical in first cost or operation, more flexible or more dependable. Following delivery of the equipment, the manufacturer must be prepared to demonstrate its proper handling, contribute practical suggestions toward its use and offer adequate service for maintenance purposes. Clearly no small order, these requirements can be fully realized only by the most intimate frankness in the exchange of knowledge, needs and aims.

This conception of mutual dependence and obligation is not new to us manufacturers. We have long felt ourselves to be an integral link in the chain of mineral production. As such we welcome the opportunity of contributing our full share to the advance of the mining industry.

Robert W. Gillespie

Clarence B. Randall

STEEL—The Child of the Mining Industry Grows Up to Help Improve Mining Methods

THE Steel Industry must never overlook the fact that after all it is really only the finishing phase of the Mining Industry. The beautiful automobile that swings so gayly along the highway in the summer sunshine lay yesterday in the open pits of Minnesota and the mountains of Kentucky, and it is the miner who makes our entire Industry possible. We often boast today of the perfect timing of our mechanical processes, but what more dramatic illustration can there be of modern human coordination than this synthesis at Chicago of the ores from Minnesota, with the limestone from Michigan, and the coal from Kentucky?

Steel being, therefore, thus the child of mining, it is fitting that mining should receive the best in service from steel, and that is the spirit of our Industry today. We know the exacting demands that the Mining Industry requires from the metals that it takes underground. Probably nowhere else in Industry is more stamina required. Loaded cars roll back and forth from the working place to the skip, subjected to alternate wetting and drying, to jets of water carrying deleterious chemicals, to the shocks of badly laid track, and to the hazard of frequent minor collisions. Occasionally, the roof comes in, and none but the toughest car survives.

We used to try to do all of this with ordinary carbon steel, but these are extraordinary times, and metallurgy has had to devise extraordinary products.

Out of this background, therefore, have come the modern low alloy high tensile strength steels.

For a long time the metallurgists have known that high alloys gave greater strength for faster speeds and heavier loads, but such products were too expensive for use in the heavy industries.

The new steels meet this test fully, however, and by the use of moderate amounts of copper and nickel, there have been created in the low alloy high tensile group, steels that increase strength while reducing dead weight, and yet steels which at the same time have a greatly increased service life and which can be cut, formed, bent, welded, and otherwise worked with almost the same facility as ordinary carbon steel.

It is unfortunate that the Mining Industry is normally the last to benefit from the upward swing of the elemental forces which now seem to be supporting business, but definite improvement now seems to be assured, and it is to be hoped that the Mining Industry and the Steel Industry may go forward together into better times.

Clarence B. Randall

A CHALLENGE

COMPETITIVE fuels, stringent specifications and new marketing conditions are indeed a challenge to the coal mining industry and, though now looked upon as added burdens, may

F. A. Merrick

be beneficial. Signs are not lacking that the challenge of these ever-changing conditions is being accepted.

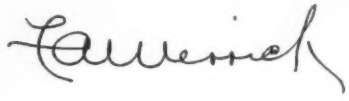
Renewed activity toward mechanization, permitting greater production from a limited area will result in reduction in cost of pumping, ventilation and general upkeep.

Rapid extraction and concentrated operation, both commensurate with demand, will not only contribute to greater recovery, but will also permit sealing worked-out portions of mines, reduce hazards and contribute toward the elimi-

nation of the much-discussed problem of stream pollution.

Recapture of lost markets is a vital and ever interesting problem. Better utilization seems to offer an excellent means of winning back much of the lost market. Effective utilization by means of automatic stokers and scientific merchandising, which may include complete heating service with ash disposal, will do much toward the elimination of the smoke nuisance and improve the industry's position in competition.

Colloidal fuel, hydrogenation, and other chemical and mechanical treatments justify the intensive research now being undertaken by the coal mining industry. The more acceptable the form of coal, the greater its marketing possibilities.



IMPROVED MACHINERY Lowers Production Costs

IT is most encouraging to survey the progress which has been made in rebuilding a sound attitude toward business development in this country since the disturbing days of March, 1933. At that time we had the spectacle of business finding itself in such a frightened condition, after having gazed for so long upon its ills, that it was seeking to solve its problems by all sorts of self-conscious attempts to balance production and sales.

When we look about now, we find all of our major industries going enthusiastically after increasing markets and volumes. We again have confidence that the American people can reach to still higher standards of living than those which they had attained in 1929, and we realize that the only means by which these standards of living can be achieved lie in lower costs of production in terms of total human effort.

The equipment builder during this period has played an important part in bringing about this change in point of view. All live and active equipment builders have been busy during the depression in developing new equipment which will make possible a lower net cost in terms of labor content and cost of equipment.

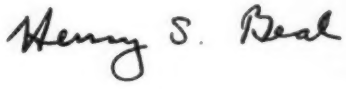
The equipment builders who serve the metal and coal mining industries have also been very active. They are serving the coal mining and oil producing industries looking toward the end of making possible cheaper power. They are aiding the metal mining industries in producing metals more cheaply, and hence making possible the development of many additional goods at lower costs.

Most equipment building companies are now making money but are not forgetting the fact that they must continue

H. S. Beal

Wm. E. Goodman

their development work and seek ever to produce improved machinery which will make possible the lower cost of production of coal, oil, and industrial metals.



THE IMPORTANCE of MECHANIZATION in the Mineral Producing Industries

ELI WHITNEY, a New England inventor, in giving the South the cotton gin, which removed the tedious hand labor of picking cotton seeds from cotton, provided an item of mechanization for the cotton industry of the South which aided tremendously in the development of the industry and in affording a livelihood for large numbers of people.

Cyrus McCormick, in developing the reaper, provided an item of mechanization which opened up the Northwest—provided the low-cost production of grain, which could then be transported and landed in the larger centers of population at a profit, and thus influenced the opening of the Northwest to large numbers of people. The same thing is true of many another invention.

While the mineral producing industries, meaning in particular the mining industry, cannot point to any individual who has contributed an important item of mechanization such as Eli Whitney or Cyrus McCormick, yet the many who have contributed features of mechanization, not only in this country, but abroad, have in the same way influenced the mining industry, which has resulted in a plentiful supply of metals at reasonable cost for innumerable products which could be made from cheap power in turn supplied by low-cost fuel.

To stop this mechanization and to go back to hand methods would be uniformly opposed. The resulting high cost of materials would be abhorrent. For example, in bituminous coal mines, using hand work to replace the undercutting machine, the locomotive, the drill and the loading machine would add at least 45 cents a ton according to a recent estimate. Elimination of mechanical hoisting, ventilating and pumping equipment in addition would bring the cost of coal to fantastic figures.

Mechanization, of course, makes it possible for coal mines to meet the competition of competitive fuels such as natural gas and fuel oil, both of which require comparatively little labor as compared with mining operations.

We who are putting our energy into the developing of machinery for mining are particularly gratified at the reduction in the drudgery attendant upon certain mining operations, and the gradual elimination of the hard, gruelling work which tends to break men down physically. It also seems to be true that with machinery, increased safety is achieved, a statement having been recently made that the accident rate was so much reduced after mechanization that money paid out for compensation was decreased to the extent where the saving more than carried the interest on the capital investment made for mechanizing the property.

At the same time that the use of machinery eliminates the drudgery of handlabor, it increases the productivity of society as a whole. In this manner, machinery tends to reduce the necessity for long hours, for child labor, and for the labor of the aged. Likewise, the reduction of the strain on the productive system made possible by the machine allows man to turn his attention to the satisfaction of additional wants—allows him to more easily fulfill his basic needs, and give more attention to the development of his cultural aspects.

I believe, too, that as mechanization goes on we shall gradually acquire knowledge that will permit the mining of minerals in the more difficult seams, which seams and veins we do not mine at the present time. With the development of new methods and machinery,

which can produce minerals from such seams at low cost, we extend into the future a continuing plentiful supply of mineral products at relatively low cost.

Mechanization of mines has made good progress in recent years, and seems destined to continue. Its objects are important, and read directly on the needs of our nation. It is inconceivable that we should consider mechanization as unimportant, and discontinue mechanization efforts with all the distress that such would entail. On the other hand, we believe that mechanization is vital and that it must go forward.

Wm. E. Wickman.

THE EQUIPMENT MANUFACTURER'S OBLIGATION to the Coal Industry

THE equipment manufacturer holds a very definite obligation to the coal industry.

Commencing with the gathering of primary data from the various coal-producing fields, consisting of detailed physical characteristics which must be met as well as the many economic factors affecting equipment operation, the successful manufacturing company assumes the position of a highly specialized research organization whose sincerity, integrity, and experience is beyond question to obtain the necessary confidence and cooperation of the producer, for desired results.

Incomplete utilization of primary data or a misinterpretation of economic factors or trends on the part of a manufacturer has not only proven costly to over-enthusiastic users of new equipment in the past, but has sometimes delayed the wide application of a much-needed development on account of a justifiable prejudice engendered by the non-performance of a new unit.

Having indicated the possibilities for the use of certain type equipment the problem of initial design is of next importance.

Many mechanisms carrying a number of advantageous developments are doomed to failure due to lack of practical operating knowledge on the part of the designers, while other ideas are constantly incorporated in machinery and are not worked out in sufficient detail in relation to the service for which it was originated.

The highest type of mechanical and electrical ingenuity must be coupled with practical experience in exact balance before a unit can be made even partially successful and no new type mechanism is ever completely designed, constructed and placed in continuous underground service without having to undergo further mechanical changes.

Due to the elemental forces against which mining equipment must contend, all materials used in the construction of such equipment must be of the highest possible quality and repeatedly tested for the particular duty for which it is intended.

Great progress has been made in metallurgy which can now be applied to machine design for definite results and the problem of meeting necessary stress and strains in proscribed clearances, together with the ability to select certain alloys for specific usages, has enabled designers to greatly simplify and strengthen all present-day equipment.

The question of skilled workmanship is not a simple one, as precision machining of complicated parts must be accomplished and exacting requirements adhered to for minimum tolerances and close limits.

Rigid inspection of all parts comprising a machine is demanded to eliminate questionable material or faulty workmanship as correct assembly and particularly uninterrupted service of the completed unit itself is dependent upon this phase of operation.

A manufacturer is definitely obligated to his customer for adequate stocking and quick delivery of standardized replacement parts, carrying the guarantee of highly specialized design, selection of proper materials, precision machining and rigid inspection, for the most dependable continuous service of the mechanism itself.

Serious interruptions in the operation of mining equipment are repeatedly traceable to the use of parts manufactured by organizations other than the originator of the unit.

To complete the final production obligation of the equipment manufacturer, the costs of research, design, materials, inspection and all labor charges must be allocated upon such an efficient basis as to leave a profit margin sufficient to care for engineering and experimental work, advertising and sales expense, insurance, depreciation, taxes and administration, plus an operating profit commensurate with good business practices and, at the same time, deliver the product to the user at a price fitting the economic requirements of specific installations, whereby net profits are conclusively proven for the purchaser within a reasonable period of time.

If the various duties of the manufacturer as above outlined, ceased at the point of product delivery to the user, his problems would be considerably simplified. However, such is not the case.

Having assumed responsibility for the promotion of certain type equipment the manufacturer becomes obligated for all recommendations made for its use and with the widely varying physical and economic conditions involved, an error in sales judgment precipitates disasterous results.

As modern practice trends more and more towards the highly specialized fields, mechanisms designed and constructed for particular purposes must

W. E. Barrow

be installed and demonstrated by the builder.

This calls for the utilization of trained and experienced men who must not only know all details of construction and application of the units, but who must be able to impart their knowledge to entire operating organizations for successful results.

Customer service is an important part of a manufacturer's duty and properly trained local personnel must be organized at each installation for efficient adjustment, repair and maintenance of the equipment.

Finally, a method of close cooperation must be established and continued between the manufacturer and the industry served, so that each may obtain and profit by the experience of the others for their mutual benefit.

It is in this spirit that this brief outline of manufacturing policy is offered.

W. E. Barrow

APPLICATION of MACHINES to Mining

THE importance of the application of machinery to the mining industry is relative to the individual property and is governed by the size or daily capacity, kind and character of the ore or mineral to be dealt with, the geographical location in relation to the disposition of the plant product, and the local economic conditions.

The mining industry covers such a broad scope that it is intended in the remarks following to refer only to non-ferrous mines. Production or mining of the ore is not referred to as it is assumed

the operations have reached a stage of development where ore can be mined at a predetermined rate of output or assured daily tonnage continuously to warrant installation of a milling or metallurgical plant for recovery of the mineral values.

It is at this stage most vital to determine the proper method of treatment.

There are very few mines and their products that are alike in all details or that will warrant duplication of a successful plant on another property whether it be in the same district or elsewhere.

It is becoming more general practice to determine the details of the metallurgy most applicable by conducting exhaustive laboratory tests on the ores before deciding upon the details of plant or machinery. In this country there are several commercial testing plants specializing in such work. There are also many mining schools of outstanding reputation conducted in connection with well-known Universities, as well as those in connection with the several State Universities, which are equipped with laboratories to conduct testing work. There are many manufacturers of equipment who are prepared to make the necessary tests to determine the correct milling methods and metallurgy suitable for the economics of the specific case.

In many cases after such exhaustive studies have been made, particularly when plants of large capacity are contemplated, pilot plants of moderate tonnage capacity are built to follow out the practice determined in the laboratory and to prove upon a working scale the procedure for the larger installation.

The practice recommended herein applies not only to building of new plants, but it is also recommended for consideration when additions to plant are contemplated, or changes required due to the character of the ore, improvement in metallurgy, improved type of machinery available, or for any other reason requiring major changes.

Once the details of the metallurgy have been decided upon the selection of the proper machinery to carry out the mechanics of the process should follow with earnest and careful consideration in which the manufacturer can lend efficient and material assistance. Experience gained from contact constantly with variable conditions in all parts of the world enable the manufacturer to give practical help in selecting equipment.

Judgment is required in recommending equipment to fit it to the conditions as obviously the refinements used in a plant of 1,000 tons daily can hardly be applied in one of 50 tons. Then again, the known or contemplated life of the mine may not justify the type of plant warranted elsewhere and initial capital investment commensurate with the specific project will be a consideration.

Many mines occur in isolated places difficult to transportation and where it is essential to apply intensive treatment to reduce the bulk of the output to a minimum. In contrast to this the mine may be so located that it is more profitable to make a product that is shipped to a custom mill, smelter or refinery for treatment of the concentrate in association with other ores.

Each mine, whether it be gold, silver, copper, lead, etc., is different in some detail from another.

General conditions and characteristics of the ore may be similar to another mine of the same nature. Some detail about the occurrence of the ore and gangue or waste with which it is found, also the hardness, will differ even from that of an adjoining property in the same district.

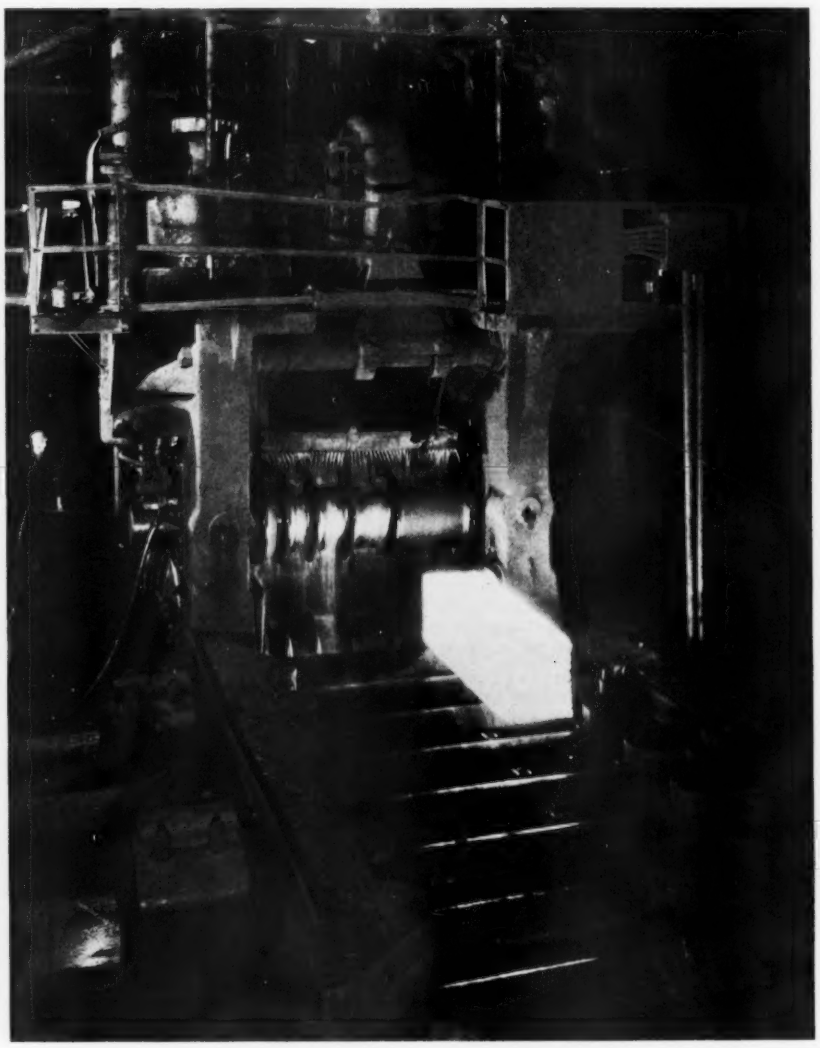
This is what makes it desirable and even necessary to have careful tests made and to consult an engineer or manufacturer before deciding that a certain process will be used or that a machine be selected because it has been successful elsewhere, maybe under entirely different conditions.

No attempt is made here to describe the method of treatment for any specific ore. It is intended to be applicable to mines outputting any of the numerous minerals. It is desired to stress the advantage of careful investigation, testing, planning and selection of the right equipment, all of which may spell the difference between success and failure.

The manufacturer is in a position to render a material aid to the operation and to the mining industry.

Allis-Chalmers maintains a corps of engineers and metallurgists capable of analysing each problem presented to them. They have behind them the accumulated experience of many years and a very extensive line of machinery from which to make the proper selection.

J. Furlong



THE ANSWER TO THE DEMAND FOR LUMP COAL . . .

Presented by | Sullivan Machinery Company
Jeffrey Manufacturing Company

MULTICUTTING in Coal Mining

By C. B. OFFICER*

IT IS essential in considering the adaptation or introduction of new types of cutting machines at any coal property, and also more particularly in the designing of such equipment for various mining conditions, to first analyze just what the fundamental requirements are that should be obtained. Reduced to the least common denominator, the principle objectives to be considered by the use of cutting machines are:

First, a reduction in the cost of mining or production of coal.

Second, an improvement in the quality of the product produced so that a higher market value may be had.

Third, a combination of the two above objectives.

The design of the equipment and its application must satisfy the above qualifications if the installation is to be a success. The question naturally arises as to what is the best type of mining machine and the best application to obtain the results desired. Coal-mining conditions have many variations, such as height, quality of coal, whether or not dirt bands or impurities occur in the seam, the type of top or bottom conditions, whether wet or dry, etc. Because of these variations it naturally follows that no one type of coal-cutting machine will be satisfactory for all conditions and that different types of machines are required for different localities.

There are mines where the longwall method is the best suited, and therefore the longwall type of machine should be used. There are other locations where the room-and-pillar system in its various forms is best suited, and for these room-and-pillar mines, depending upon their local conditions, either shortwall machines or track machines putting in single horizontal cuts or track machines putting in multiple cuts should be used.

The track-type machine capable of multi-cutting, being the latest development in coal-mine cutting equipment, naturally raises the question as to what the advantages of this type unit might be and where this type unit might be applied to obtain the fundamentals mentioned in the first paragraph of reducing the cost of mining or increasing the quality of product produced, or both.

Briefly, the various places where multi-cuts might be used to advantage are outlined as follows:

First, there are conditions where dirt bands exist in the seams that are thicker than can be removed with a single cut or where these dirt bands are of such a texture that they cannot be cut, and in order to remove same it is either necessary to make two cuts in the dirt band itself or a cut above and below the dirt band in order that it may be removed economically. Each condition of this nature requires special study in order to apply the right mining method and the right cutting equipment for such method.

Second, there are conditions where the nature of the top and the nature of the bottom would indicate the desirability of having not only a top cut for the top protection that might be obtained but also a bottom cut, in order that the coal might be loaded easily and without adding too many impurities. With this condition it is generally advisable to study the mining method and equipment to be used and determine whether it might be best to put in a single bottom cut with either a single or double cut shear, so that a lower mining cost and a further improvement in the cost of production might be had.

Third, those conditions where horizontal cuts either in the top or bottom may be used with either single shears in the center or double shearing on the rib. This condition is the latest development in mining methods, and also equipment for such methods.

The savings that may be obtained through either top or bottom cutting with rib shearing will vary with local conditions. Many of these savings, and also the advantage in improvement of quality of product, will occur for all conditions where multi-cuts should be applied. Some of these savings to be obtained can be enumerated as follows:

With multi-cuts, since a greater number of faces are exposed to which the coal may be shot, a fewer number of holes are required to be drilled for shooting operations.

With a fewer number of holes being drilled, less powder or explosive is required. The degree of saving on these expenses has varied as much as a reduction to one-half of the cost, and in some cases to one-third of the cost, as compared to similar costs with a single undercut.

Due to the improvements and advances that have been made in the design of the machine itself, the improvements that have been made in the quality of steel, plus the fact that additional faces are provided to shoot to, narrower kerfs can be used with the multi-cuts than with a single cut for these same conditions where a thicker kerf would be required. In other words, with a single cut a 6-in. kerf removes a certain amount of material and a single additional face is produced to which the coal may be shot. With a horizontal cut plus two rib cuts, three additional faces have been obtained to which the coal may be shot, but the sum total of the volume removed, because the multi-cuts can be held to a 4-in. kerf, is practically the same as the volume of material removed from a single horizontal cut. The difference in the thickness of the kerf cut not only means a reduction in the power required for cutting the material but also means a speeding up of the cutting operations. It is hard to distinguish just how much of the speeding up the rapidity of cutting of the multi-cut type machine may be due to this reduction in kerf and how much may be attributed to improvement in the qualities of the materials used in modern design because of advancement in the arts of steel-making and how much may be attributed to the improve-

* Vice President, Sullivan Machinery Co.

ment and modernization of the designs of the machines themselves. In sum total, however, the rapidity of cutting with modern multi-cut machines has to be recognized as a distinct advancement in the art, with corresponding reductions in operating costs.

Where multi-cuts have been used a decided difference has been noted in the way coal is loaded after these cuts, either by hand or loading machines. The fact that the ribs have been sheared means that the tight corners have been eliminated, giving a much freer face to be loaded, with a corresponding increase in the capacity of the loading machine and a decided reduction in the upkeep cost of these machines, because the hardest part of their work has been eliminated. The increase in loading-machine capacity has been noted in some instances to be as much as 10 to 15 percent.

In many places where timbering expense has been a decisive factor on the cost of mining there has been shown a sufficient reduction in this one item to justify the purchase of a unit that would put in multi-cuts, as with the proper multi-cuts and the small amount of powder used, the ribs themselves have not been powder-shattered, the roof has not been powder-shattered, and therefore less timbering was required to maintain safe working conditions.

Another advantage in multiple cuts with rib shearing is the difference in underground ventilation. Straight ribs on the entry decidedly reduce the friction of the air passing through. A reduction in the water gauge required at the fan means considerable difference in the power required for ventilation of any coal property.

For similar reasons as those that permit of less timbering expense, it has also been found that due to the firmer pillars produced by rib shearing, narrower pillars can be left without in any way changing the safety conditions.

Where multi-cutting has been used there has also been noted an improvement in the type of product produced. The improvement in the type of product carries through more pronouncedly when the differences are compared at point of delivery. In other words, coal that has been less powder-shattered stands the shocks of transportation better, and the percentage of lump or large sizes is practically the same at destination as it was when the coal was loaded.

With the extra faces to which the coal can be shot, the smaller amount of explosive required, the easier digging with the loading machines, there has also been an increase in the percentage of larger sizes produced and a corresponding decrease in the percentage of fines.

In other locations it has been found that with multi-cutting laminated impurities can be more easily removed, because these impurities can be pulled out in large chunks and do not become finely broken up to be mixed with the other product.

As a summary, it may be stated that for the majority of mines where the room-and-pillar system of mining applies that serious consideration should be given to the economies that might be obtained by the introduction of multi-cutting equipment.

What SHEARING Accomplishes in Mechanical Loading

By EDWIN H. JOHNSON*

CUTTING machines that will make vertical as well as horizontal cuts in the coal face are becoming increasingly popular among the users of mechanical loaders, principally because the shear cut with its extra free face provides greater freedom for the coal during shooting, and consequently easier machine loading.

It has been the universal experience of users of loading machines of all types that the final product of the mine carries a considerably higher percentage of screenings than is produced by hand loading. Due to the lower selling price of screenings, this often represents a serious loss. Along with growth in the demand for stoker coal for industrial and domestic use has come the further demand for lower ash and higher fusion in these sizes, resulting in added cleaning costs and a final realization in some instances little better than before.

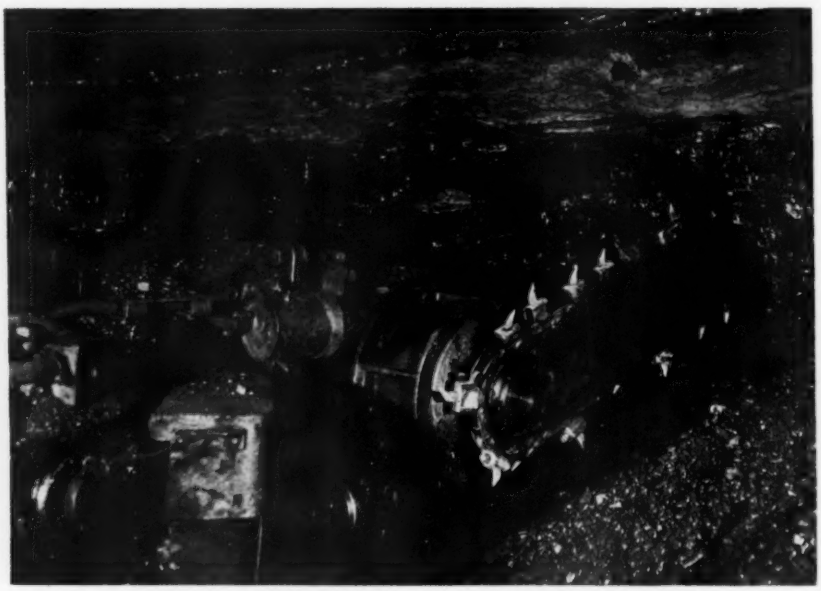
In some quarters attempts are being made to load the highest possible tonnage per unit, regardless of grade or quality. In recent years, however, the operators of commercial mines more generally have been placing increasing emphasis on net realization, so much so that they have imbued the mine superintendent, mine foreman, and their assistants with the same desire. In consequence all are definitely aiming at the highest possible realization from their product. This aim has not been without result, for the mines that have made a success of mechanical loading have found that something can be done about it other than to hold down the loading rate below economic limits in order to get greatest percentage possible of coarse coal.

The grade of coal and the loading rate with any type of mechanical loader are more affected by the cutting practice than by any other variable except supervision. The inability of the average shortwall operator to cut a straight rib has caused so many "stuck" shots, and the imperfect removal of bugdust from the kerf has so often caused the coal to bridge, that the temptation to overshot the coal has been too strong to resist. These difficulties are being overcome by the use of track-mounted machines which cut and shear. With a track-mounted machine it is just as easy to cut a straight rib as to gouge it; and, although it is still important to get the dust out of the kerf, failure to do a thorough job in this respect does not so severely penalize the operation of the loading machine when coal is sheared.

Shear cuts made with machines equipped with long cutter bars increase the yield in tons per face fall while still maintaining balanced shots for proper distribution of the force of the blasting charge. In the same width and height of working place this practice promotes efficiency in the cycle of face operations, since the tonnage that each operation produces is thereby increased and the delay in moving all equipment from place to place is reduced.

A most interesting discussion of certain comparative results between shortwall machines equipped with a standard

* Manager Loading Machine Division, Jeffrey Manufacturing Co.



A Jeffrey Combination Cutting and Shearing Machine at Work

kerf bar and track-mounted combination cutting and shearing machines with a longer, thin kerf bar took place at the recent meeting of the Illinois Mining Institute. It brought out the following advantages in favor of the latter:

1. Thirty percent more coal produced per cut.
2. Seventy percent more coal cut by the cutting crew.
3. Seven percent less screenings produced while cutting.
4. Fifty percent more coal produced per pound of powder.
5. Twelve percent less screenings in the mine-run product.
6. Twenty-five percent increase in loading rate for the mechanical loader.
7. No loss in loading rate in the handling of entry coal.

Obviously, item 3 is directly attributable to the thin kerf bar and would vary somewhat according to the relation of room width to seam thickness. The other items are essentially advantages in favor of the combination type of machine with long cutter bar and without regard to the thickness of kerf.

One of the very important contributions of the universal type of cutter is that of aiding the selective mining of the coal. In many cases the existence of dirt bands in the seam has been thought of as making the adoption of machine loading impossible. But to an increasing extent dirt bands are being cut out and gobbed in the mine, leaving the balance of the seam clean enough to be handled effectively by a loading machine.

In any mechanical loading system the most vexing problem is that of so balancing the capacities of the various units in the cycle as to produce a high average of efficiency. The loading machine, as the actual producer, frequently becomes the pace maker for the other equipment. But the loader capacity usually is not an even multiple of the capacity of a gathering crew, or a crew of cutters, drillers, shooters, trackmen or timbermen, unless careful consideration to these factors is given by the management in the original selection of the equipment. Frequently some slight modification of the mining system can be adopted for the purpose of building up the capacity of some one unit that has been lowering the overall efficiency of the entire system, thereby putting all the units into better balance.

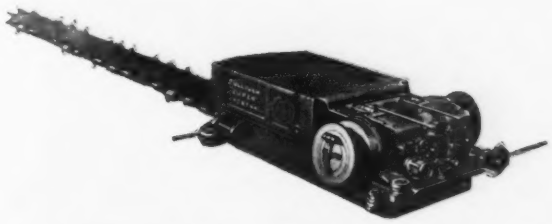
The best assurance of efficient coordination of equipment is a complete time analysis of every operation in the production cycle. Where this can be used as a basis for estimate on closely parallel conditions, it is usually possible to make forecasts of performance that are surprisingly accurate. As one mine operator recently expressed it, "We used to figure the importance of mine delays in fractions of hours. Now we use stop watches and make our calculations in fractions of minutes."

● A NEW PUBLICATION, entitled "Safety Progress," has just been published by the Mine Safety Appliances Company of Pittsburgh, Pa. It is intended for the particular attention of those key executives in the industrial world whose interest in the safety and general well being of their employes is of paramount importance. The contents of this profusely illustrated brochure, are best summed up in the author's own preface: "The Case-History of a modern Crusade . . . a hard-fought campaign against a multitude of industrial hazards that, collectively, have claimed many more victims and worked greater hardships on humanity than ever the Saracens did. For the results that have been attained, the lion's share of the laurels must go to those safety-minded executives in every industry, without whose encouragement and assistance our own efforts could have availed but little."

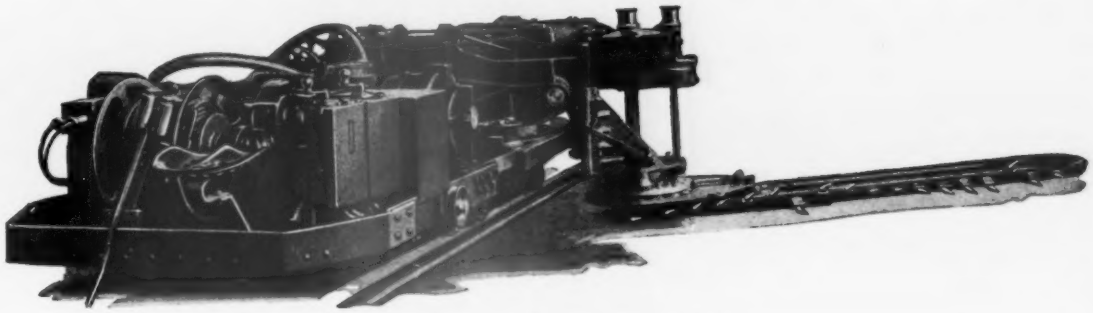
● THE SULLIVAN MACHINERY COMPANY announces the publication of two new bulletins, one in connection with its new line of drifters, the other describing its detachable bit and its advantages, the title of the latter being "Sullivan Writes a New Chapter."

● ROBINS CONVEYING BELT COMPANY has made a sales agreement with the Mine and Smelter Supply Company, of Denver, Colorado, Salt Lake City, Utah, and El Paso, Tex., for the sale of Robins equipment in the states of Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming and in parts of Idaho, Nebraska, South Dakota, and Texas.

● SALES of "Mitco" interlocked steel grating, "Mitco" shursite treads, and "Mitco" armorgrids for the New York City district are being handled by the Hendrick Manufacturing Company's branch office at 30 Church Street, of which Mr. B. G. Dann is manager. This sales arrangement became effective May 1. Mr. Richard W. Tull, formerly of the Mitchell-Tappen Co., its New York district representatives for the past 11 years, will specialize in "Mitco" products.



Sullivan 7-B Super Shortwall Coal Cutter



Goodman Mounted Bottom Cutter Type 324

GETTING THE ANSWER WITH MECHANICAL LOADING . . .

Presented by | Goodman Manufacturing Company
Joy Manufacturing Company

Physical Conditions Which Determine the Effectiveness of MOBILE LOADING MACHINES

By FRANK CARTLIDGE*

PHYSICAL conditions encountered in the mine may, for the sake of this discussion, be divided into two classes: those imposed by nature, over which the operator can exercise but little control, and those which are due to outside influence.

In the former group we may include the peculiarities of the seam itself and, of major importance also, roof conditions. It is obvious that the mechanical-loading system installed must, first of all, meet the natural underground requirements, if successful results are to be obtained.

Take, for example, the seam. A height of 5 ft. usually is needed for clearance and to provide the mobile-type loader with adequate tonnage volume. Then, too, the nature of the seam has much to do with the benefits to be derived from mobile loaders.

Where coal is streaked with impurities or where sulphur and dirt bands exist, too much time and expense may be consumed in separating and gobbing. My experience has been that a too thick band seriously handicaps the effectiveness of mobile loading, unless perhaps the problem is solved by face preparation. Progress in this direction has been effected through the use of track-mounted machines which are built to cut a kerf in the most advantageous level of the seam, thus permitting impurities to be removed and separated from the coal at the face.

The nature of the coal and whether it has a pronounced cleavage is another factor to consider. Where the cleavage runs both horizontally and vertically, the coal usually comes down in better condition to load. Good results often can be obtained by working the seam either with or against the cleavage. In some western mines, where the coal is high and hard and there is no distinct cleavage, the chunks may be too large for mechanical loading efficiency.

Level seams, of course, are ideal for mechanical loading. Moderate grades are common, however, and do not interfere greatly with the mobile-type loaders. It is the pitching seam of more than 7° angle that retards efficiency to a large extent. Steep grades affect not only the manipulation of the loading machine but also the movement of cars to and from the loader.

Good roof and freedom from props are ideal for mechanical loading. The loading operation is less restricted and the system of mining can be made to accommodate larger rooms, which will yield greater tonnage with fewer moves from room to room.

The trend in mining practice, however, favors room width be limited to comfortable working area for mobile loading efficiency. Otherwise, excessive maneuvering and frequent adjustment of rear conveyor may result in time loss periods. Rooms sufficiently wide to permit unhampered movement of the loader, but narrow enough to keep it within close range of its work, offer the best opportunity for economy and productiveness. The speed of the machine while gathering its load or in tramming from room to room is a determining factor in scaling down production costs.

Bad roof conditions will retard any type of mobile loader. If slate comes down with the coal, for instance, it may be extremely difficult to make mechanical loading pay. Timbering is another obstacle, but less of a handicap for the track-mounted type of mobile loader than to the caterpillar-tread machine. This for the reason that the track machine does less maneuvering for position and its loading head can swing in less space than would be required to maneuver the caterpillar type of mobile loader.

Because the track loader attacks its work in this way, its operator is in a safer position, farther back from the face. This is advantageous in case of dangerous top.

All of the conditions named are so well known that I have mentioned them but briefly. It now seems desirable to discuss other physical conditions under which mobile loaders are required to work and which are more or less dependent upon the mine management.

The physical force used for operating mobile loaders of present-day design is electricity. To obtain maximum motor efficiency the conductors should be large enough to deliver full load voltage to the machine at all times. Otherwise loading capacity will be reduced. When a cutting machine falls behind its schedule, the work can be made up on an extra shift. Loading machines, however, are required to complete their schedule each shift, as they can work only when the hoist is in operation. Hence the importance of having the loader operate to its full capacity.

Consideration of the track is all-important, too. Speedy transportation is essential to satisfactory loading output. Good track, well secured with a tie and fishplate connected with two bolts at every joint—track that is straight and free from waves—large radius curves with the outside rails slightly higher than the inside—a good throw latch at every switch—all these conditions must be met to facilitate speed of handling the cars.

Long-distance haulage would be fatal to acceleration of car supply. Switches should, therefore, be kept close to the working face. As it is not practical to haul the full distance of the ordinary room, switches should serve to move the cars and the machine itself through the crosscuts.

Low, wide, large-capacity cars are effective in maintaining loading efficiency. Cars too small (1 to 1½ tons) require excessive shifting. Unnecessary height elevates the angle of the discharge conveyor and retards movement of the coal. A narrow car is harder to locate with the rear conveyor and contributes to delays.

Large car wheels with wide treads are a protection against derailment. Roller-bearing cars are preferable. Locomotives of sufficient capacity to start trips easily save time. Cable-reel locomotives are more commonly used, but there are no objections to battery locomotives of sufficient capacity.

Face preparation is very closely related to good loading results. It is a subject of too much detail to discuss fully here, but one vital phase meriting mention is the condition in which the coal is laid down to the loading machine.

The ideal coal to load with a mobile

* Engineer, Goodman Manufacturing Co.

loader is that which lies in chunks of from 1 to 2 ft. in cross section. The nature of the seam, the method of cutting, and the system of shooting must be studied to bring best results.

Seams of coal vary and the method of dislodging the coal from the face can often be improved to make the loading operation more productive. It has been my observation that there is a tendency to drill too few holes and use too much explosive. This shatters the coal in the vicinity of the shot, but leaves solid, oversize lumps between the holes. These latter may be so large that they are broken during the loading operation because they will not pass over the conveyor of the machine. The percentage of fine coal is increased under these conditions, whereas perhaps a greater number of holes with better distribution of explosives would produce better results.

Where the coal has a tendency to stick up at the face and has to be undermined by the loading machine, there will be a high percentage of fine coal. Much better results will be obtained if the coal is blown out from the face, even though it appears in much smaller chunks after the shot.

MOBILE LOADER Application

By WALTER M. DAKE*

THOUGH mechanical loading has been an established fact for many years, until a short time ago the general opinion was that it could only be utilized in high seam mines, opened under the ideal physical conditions of no impurities and no restricting timbering and thus calling for the solution of a relatively simple problem of organization.

Undoubtedly an easier application is presented by good seam conditions, where capacity tonnages are obtained per cut and large type pit cars are used for transportation behind the loaders; however, experience has shown that at least the same, if not a greater percentage of production costs can be saved by mobile type loaders under poor conditions.

A very definite reason for this seeming anomaly is that adverse physical conditions are penalized by higher costs for yardage in narrow development and increased dead work such as heavy timbering and the removal of impurities with consequent abnormally high total costs, against which mechanical loading crews can show a comparable profit at a much lower tonnage output per shift.

Another distinctive and seeming deviation from general acceptance is the fact that mobile type loading machines can and do save costs proportionately with high seam mines in decreasing seam thickness.

This is due to the increased wage and contract rates for coal seams of thinner working heights as compared with thicker measures.

The necessity for increased tonnage output per employe for decreasing production costs was recognized by the manufacturer of mobile loading machines sufficiently in advance to allow final research and preliminary design of different units to fit the various physical and economic conditions in the thin seam fields, with the result that experimental work has been concluded and proven machines are now operating in many new localities.

Basing all projections on the fact that mobile mechanical loaders must justify their installation only by net cost savings and having already proven the fallacy of "the larger the tonnage produced per machine shift the better the operation" regardless of the number of men constituting the crew, a series of units were constructed to allow a selection of mechanisms to fit widely varying operating requirements.

To definitely illustrate comparable cost savings under different physical or seam height conditions, it is noted that large heavy-duty mobile loaders producing 400 tons per machine shift in good conditions and employing a 20-man crew for the necessary operating cycle, returns an average of 20 tons production per man.

A smaller, lower production capacity unit, in worse conditions or in thinner seam operations where less tonnage is available per working place, producing an average of 300 tons per machine shift with a crew of 15 men also shows an average of 20 tons production per man on the crew.

A still smaller unit, working under adverse physical conditions or in restricted clearances, producing 200 tons per machine shift with a crew of 10 men equals a 20 ton production per man; while extremely detrimental conditions or excessively low seam height will return exactly the same production per man with an average output of 100 tons per machine shift and a crew of 5 men employed on the unit.

Though these ratios of tonnage produced per man on the crew are identical, cost savings will generally show an increase over ideal operations or high seam production, due to the greater cost for adverse conditions or for thinner seam output.

In order to meet the demands of the producer and at the same time fulfill all economic requirements, mobile mechanical loaders had to be designed and constructed to smaller overall dimensions, less power consumption, with considerably reduced capacity per minute on account of restricted tonnages available and for installation at a sufficiently low price to insure lessened capital investment and carrying charges on the equipment as figured per ton of annual production from the property.

Also these units, though designed and constructed to smaller overall dimensions and of lessened weight, could not sacrifice mobility, ruggedness nor efficiency in their operating functions when compared with the established larger and heavier type units.

The solution of the double problem in meeting prescribed physical dimensions and lower prices for smaller size mobile loading machines, now presents increased possibilities for additional savings in many high cost mines.

Probably the greatest controversial phase of mechanical loader application is impurity removal, as purchasers of fuel demand and markets are now able to supply coal of standardized ash and sulphur content.

This question is being rapidly settled by the various cleaning plant manufacturers employing both wet and dry methods and at decreasing unit cost to the producer.

Where well defined or banded impurities occur in the seam, great strides have been made in the application of simplified, more flexible and higher capacity cutting machines for coal face preparation ahead of the loaders. Many recent installations of mobile loading machines have proven possibilities of bench-mining deposits carrying banded impurity both economically and with perfect safety, due to the minimum heights to which units are now constructed so they can reach to the back of a cut and to the fact that the runner is not exposed to the accident hazard formerly experienced under hand loading conditions.

Extensive research has been completed and experimental mechanisms are now being applied to the problem of converting limiting physical conditions and high cost mining requirements under hand loading practices, into safe high-tonnage mechanical loading operations for low production costs.

Many logical though formerly impossible mining methods to allow the full utilization of mobile type loaders, may be definitely forecast for the near future, through continued evolution of the experimental equipment now in process.

The first step in these newer methods has recently been proven by the conversion of the long contemplated theory into actuality, where mobile loading machine capacity is more fully utilized by continuous transportation behind the unit than by the former standard method of single pit car service, entailing the higher percentage of shift time losses in non-productive car switching.

Successful installations have now been operating in a number of coal-producing fields for sometime past, where the combination of lower and smaller capacity loaders with conveyors is rapidly converting former high cost properties into profitable operations.

With mobile mechanical loaders now available in small sizes and at prices fitting the economic requirements imposed by limited tonnages, small crews are working in concentrated mining sections to reduce time losses for machine moves to a minimum, and are loading into continuous extensible and contrac-

(*Concluded on page* 62)

* Consulting Engineer, Joy Manufacturing Co.

FACTORY METHODS APPLIED TO MINES . . .

Presented by | Jeffrey Manufacturing Company
Goodman Manufacturing Company
LaDel Conveyor and Manufacturing Company

Experience Answers Definitely—CONVEYOR MINING is Successful

By E. B. GELLATLY*

MUCH of the writing on various types of conveyors and conveyor mining in the past has been primarily theoretical, because the industry lacked a sufficient accumulation of experience to speak with undisputed authority. Today the situation is different, for conveyors have definitely proved their economic worth in the mining of both bituminous and anthracite coal. They have been responsible for winning coal that could not have been gotten otherwise under the present competitive market. They have been responsible in other cases for economically getting through extremely low sections of coal and reaching higher coal further in advance, thus eliminating the necessity for long outside hauls or possibly additional plants. To mines in many sections of the country conveyors have become the economic salvation, particularly where the coal is low and the top bad.

Labor, to an extent, at the start opposed conveyors, but now, on many of the properties where this equipment has been used for any length of time, there is a waiting list of applicants for work. The average veteran conveyorman, having learned the knack of the job, will leave a property rather than go back to the old hand-loading work. While it is true that conveyormen are kept more continuously at it during the shift, their job no longer entails such back-breaking duties as car pushing, moving heavy rails, etc. Another thing that makes conveyor work desirable to the miners is the fact that invariably it enables them to work in gangs, which gives them a companionship they do not otherwise have. The gang method of working leads to a higher degree of safety, what with one man looking out for the other when bad top is encountered, etc. In these respects it appears that conveyor mining is well over the hump and that labor in the future will accept this form of mining as a desirable and profitable task.

With the increase of emphasis on lower mine costs, notable progress has been made in conveyor methods, in the last three years especially. Whatever their nature, these methods finally boil down to the one thing that is uppermost in all cost operators' minds, and that is concentration, which to them spells cost reduction. By the use of modern conveyor methods, such as four rooms discharging to a gathering conveyor on the butt entry, or more than four rooms discharging to a butt-entry mother belt, tonnages as high as 600 tons per day in two shifts can readily be had in coal as low as 36 to 40 in. With this method there is a saving at the face, of course, but the big saving comes from the fact that one butt entry in low seams of coal will produce a large tonnage. In the case of a 1,200-ton mine, it is safe to say that the tonnage could be produced by working rooms on two butt headings, while advancing a third butt heading and one set of mains. In nongaseous mines where rooms can be turned in both directions, the necessity of driving butt headings is materially reduced, to say nothing of yardage reduction, etc.

By and large, when depreciation, maintenance, and all factors are taken into proper account, the driving of headings with conveyors cannot be expected to effect large direct savings, because a large amount of equipment is tied up for small tonnages. However, in numerous cases substantial savings are made in yardage and rock work, as no more than 40 to 45 in. of height is needed in the conveyor heading and so the taking top or bottom is completely eliminated in the air course. Furthermore, it should be kept in mind that in driving headings with conveyors so much speed is attained that a substantial saving in heading investment results.

The present trend is decidedly toward more and more conveyor mining, not only in the number of mines using it but in the growing intensity of its use in individual mines. The graduation upward from (a) partially conveyorized butt entries to (b) fully conveyorized butt entries and finally to (c) 100 percent conveyor mines is growing more pronounced.

Conveyors have now gone far enough to have clearly demonstrated their real value for complete conveyorization of new openings. There are at the present time eight mines in the United States that do not have a locomotive or mine car in them. The investment that normally is put into track, locomotives, mine cars, etc., will about offset the required investment for conveyors. It is my opinion that in a comparatively short time 100 percent conveyorized mines will be a common thing in this country.

Practically all of the underground conveyor manufacturers today are spending considerable money in the development of equipment that will give long service at a minimum cost, confident that the trend is toward considerably more conveyor activity. With this progress is the growing realization that units of one certain design and given dimensions cannot be applied to a wide number of conditions. The units must be *tailor-made* in the sense that, like store clothes, there will be a pattern and size for almost every representative requirement. To illustrate, the Jeffrey Manufacturing Company at the present time is in position to furnish some 20 different types of proven units. This number will be increased by the development of new types as occasion demands.

The need for care in the selection of conveyors with respect to conditions cannot be emphasized too forcibly. One of the factors retarding maximum progress in conveyor mining has been the attempt to apply a relatively few conveyor types

* Manager Underground Conveyor Division, the Jeffrey Manufacturing Co.

A Jeffrey 61-W Conveyor Gathering from Four Jeffrey 61-AM Room Conveyors

to all conditions. This frequently has meant failure of the conveyor mining system, not because the mining could not be done with conveyors but because the equipment used was not adaptable to the conditions. Consequently, the miners could make no progress. In view of this, the operator who has had no experience in conveyor mining ought never to attempt to conveyorize his mine without first consulting some experienced underground conveyor man. Another reason for caution is that very often equipment which will work in one section of the mine may not be adaptable to another section. Such pitfalls can be avoided by taking advantage of the experience gained over the past 10 or 11 years by men who, by being shoulder to shoulder with the situation, have acquired an extremely practical knowledge of what particular type of conveyors can be applied advantageously under every specific condition. Sometimes it may be necessary to compromise on ruggedness in a conveyor design in order to impart portability and permit the proper handling of bad top. Such things are best known by the specialist.

While the following counsel has been given many times before, it warrants repetition; namely, that successful conveyor mining is about 75 percent proper management. Conveyors, like all other forms of mechanical-mining equipment, demand close attention and supervision. No operator can expect to buy a number of conveyors, send them into his mine, and see the coal roll out at a reduced cost without increasing supervision. The greater supervision may at first appear to be an added, needless expense, but experience has shown that its benefits repay the cost many times by improving the efficiency of conveyors and labor.

CONVEYOR for Entry Development

By LOYAL F. CRAWFORD*

IN THE development of entries in the mining of coal, they are either driven narrow or wide. Narrow is usually classified as 15 ft. or under, and wide is classified as 15 ft. or over.

The methods of entry development in low and high coal differ with respect that in low coal rock is mined in the main entry above or below the coal for sufficient height. In the low coal, and in narrow entries where rock is mined, it is loaded in mine cars and transported out of the mine, while in the wide entries the rock may be stowed.

The height of the entry in low coal depends on the purpose for which it is used, and the heights vary in the entries used for main-line haulage, secondary haulage, manways for traveling and ventilation.

The application of conveyors for entry development is usually confined to seams of coal too low for the use of mobile loaders and also to seams of high coal which have too great a pitch for the use of the mobile loader.

There are two types of conveyors suitable for the development of entries. These are the flight conveyor and shaker conveyor.

The shaker conveyor is the most suitable for entry development where it can be applied, due to the lower first cost, lower development production costs, lower maintenance, and the possibility of full mechanical loading through the application of the use of the duckbill applied to both loading the coal and the rock taken from either the top of the coal or the bottom under the coal for entry height. The limitations of the application of this type of equipment are excessive adverse grades and sharp variable grades.

It is in these conditions that the application of the flight conveyor is best suited. The shaker conveyor, however, lends itself more readily to flexibility of alignment, ease of extension of the trough lines, and the use of a wide loading pan for a long throw of coal, this particularly in seams of low coal.

With the use of conveyor for entry development greater rapidity of advancement is obtained, with ratios reported of three to five times the speed of advancement over that obtained by hand loading in mine cars. Their use permits the opportunity for better organization, for double and triple shifting.

Rapidity of entry development through multiple shift, especially in seams of low coal, permits of greater production capacity, also concentration of production, resulting in lower production costs in transportation maintenance of roadways, power lines, ventilation, and drainage.

* Mining Engineer, Goodman Manufacturing Co.

Application of CONVEYORS to Coal Mining

By G. R. WHITNALL*

THE many factors which contribute to the necessity for effecting reduction in the cost of mining coal are well known to the coal trade. Conveyor systems and individual conveyors used underground have come into rather general use during the last two or three years.

While there are many types and designs of underground conveyors, all of these may be divided into three general classes, namely, shaker conveyors, chain and flight type, and belt-type conveyors.

Improvement in design, reduction in bulk and weight, simplification mechanically, reduction in power consumption, and decided reduction in maintenance have been built into all three types of underground conveyors during recent years and have fitted this equipment in practical fashion to underground use.

Necessity has certainly been the mother of invention in this particular field, since with the mining of low seams necessity has existed for the use of conveyors, and with this have come the radical improvements in conveyors that have gone a long way toward making their use economical and effecting reductions in the cost of mining coal.

* Sales Manager, La-Del Conveyor & Mfg. Co.

Shaker conveyor drives have been radically reduced in bulk and in weight, permitting their use in even the lowest of coal. The conveyor sections in past years weighing 300 to 400 lb. in a 10-ft. length have been reduced to 150 to 175 lb.

Perhaps the right-angle turn in shaker conveyors constitutes the most outstanding development. In recent years this has been developed to a practical point, and is now in general use in both bituminous and anthracite mines.

This type of conveyor turn permits extending the main line of conveyor troughing around the turn and across the face, thus conveying coal with the use of a single drive and a single motor for both the room and the face conveyor, with the attending simplicity mechanically and electrically. In gaseous mines particularly, even permissible electrical equipment forms both a hazard and an expense.

Chain and flight type conveyors, both of the room and the face design, are decidedly more compact both as to drives and as to sections. Decided improvements have been effected in the flight and its attachment to the conveying chain.

The discharge point has been developed to be self-cleaning, and the tail-section adjustments or takeup have been provided with rustless screws and nuts that are not affected by water or acid conditions in the mine.

The belt conveyor is coming into prominence in the soft-coal fields principally as a mother conveyor or gathering conveyor. A series of room-type conveyors, ranging from 2 to 10, discharge onto the gathering conveyor in the butt entry, which, in turn, conveys out to and loads the coal at one central loading point in the haulage entry.

Five or six years ago, with few exceptions, belt conveyors were a novelty in the soft-coal industry. Today, however, concentrated mining with conveyors with a single butt entry frequently producing 1,000 tons per day of three shifts or more, the belt conveyor becomes a necessity, since it is the only one of the three types of conveyors capable of handling the peak tonnage necessary and yet being sufficiently flexible, compact in dimensions, and light in weight for underground use.

Improvement in the training of long centers gathering-belt conveyors ranging upwards of 1,800 ft. in length, has developed to such a point that these units, as troughed belts, may be easily aligned and may be operated in either direction, yet retaining positive alignment for the belt.

Reversibility of belt conveyors is a necessity in many cases where supplies must be conveyed in on the conveyors.

Sealed bearing-belt idlers which require neither lubrication nor attention of any kind are a further recent development of real importance to the coal industry. Long belt conveyors frequently contain as many as 3,000 or 4,000 bearings, and the necessity for sealing them to avoid maintenance is of great importance; in fact, the complete installation may be dependent upon this one item for its successful operation or failure mechanically.

Reduction in power consumption on underground belt conveyors has recently been effected to permit operating single conveyors as long as 1,800 ft. or 1,900 ft., handling 150 to 200 tons an hour, with a peak power consumption of 11 to 12 hp.

All this has permitted reducing the bulk of the drive, the weight of the drive, of all mechanical parts, a reduction in cost of the rubber belt; in fact, a general refinement of belt conveyors to such a point that they are constantly becoming more economical both to purchase and to operate.

Without many of the improvements and refinements in design and manufacture that have been accomplished in the three types of conveyors noted, there are many instances where this equipment would be impractical, particularly in low coal.

With these improvements, it has become practical to mine veins as low as 24 in., and at a cost per ton that compares very favorably with mining costs in much higher seams.

We trust the foregoing may be of interest, and would suggest that we have observed many and have many installations of our own bearing out the several points mentioned.

We have noted installations of seven or eight years ago with equipment in a crude stage of both design and manufacture that prevented successful conveyor mining, and mines with similar conditions are now successfully mining with conveyors, carrying with it the reasonable assumption that a moderate proportion of the success is due to the improvement in this class of equipment generally by all manufacturers.

● SULLIVAN MACHINERY COMPANY announces a new bulletin (No. 88-W) describing the company's line of compressed air aftercoolers. Features stressed are the multipass design which insures maximum cooling efficiency from the water available, the use of a built-in separator which effectively removes from the air the water and oil condensed in the aftercooler and the provisions made for quick easy cleaning of the cooling tubes.

● PETRIE TRACTOR & EQUIPMENT CO., with offices in Billings, Butte and Great Falls, Mont., have been appointed distributors for Link-Belt crawler shovels, draglines and cranes for the State of Montana.

● A NEW RHEOLAVEUR bulletin "Rheolaveur Coal Preparation and Cleaning Plants" has just been issued by The Koppers Rheolaveur Company.

SPEEDING THE WHEELS OF PRODUCTION . . .

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Ohio Brass Company
Bethlehem Steel Company
Electric Storage Battery Co.

Low Height HAULAGE LOCOMOTIVES Reduce Mining Costs

By D. E. RENSHAW*

THE cost of transporting coal might appropriately be considered as consisting of two elements. Generally, the major element is the direct cost of power, labor of the haulage crew, maintenance of equipment including track and overhead, and other items roughly proportional to the amount of coal transported. The other part is indirect and consists of the first cost and fixed charges on the investment in equipment and haulage ways, including cost of grading and taking down additional top where necessary to provide additional height.

In low coal this second part may be an item of major expense but, in many cases, it can be greatly reduced through the use of low height haulage equipment.

For example, certain mines in the Pocahontas Field of Virginia and West Virginia have an average seam thickness of 52 in., with a top which can be safely supported without removal of additional material. Roof supports and track take up 12 to 13 in., leaving an average net headroom of 39 in. which is pinched down in some places to a minimum of 34 in. Cars are 26 in. high, but are topped to 39 or 40 in. where this much headroom is available.

Under such conditions, it has been necessary in the past either to haul the coal in uneconomically small trips with small locomotives; or to operate two small locomotives in tandem to make larger trips possible; or to take down enough top to permit the use of heavier, higher locomotives. Any one of these three methods involves added expense in wages for haulage crew, or in first cost and maintenance expense for equipment, or in cost for dead work. In short, the best equipment and methods which have been available for low vein haulage have not been efficient.

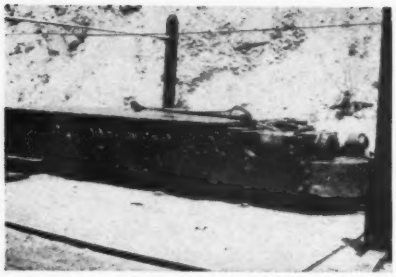
* Industrial Department, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

15-Ton 32-Inch High Locomotive at Pit Mouth

Recently, operators in this field have placed in service locomotives of a new design which operate under a minimum headroom of 34 in. These locomotives, ranging in weight from 13 to 20 tons, and equipped with two 110-hp. slow-speed motors, have sufficient capacity for main haulage service. Because of their low height, short wheel base, and three-point equalized suspension, they can work into any section as far as the trolley wire is erected over the curves and temporary tracks installed for gathering service. Since it is necessary for the motorman to sit on the foot pan when working under low roof, and in this position he is unable to manipulate a brake wheel, sand levers and a drum controller easily, these locomotives are equipped with air brakes, air-operated sanders, and electro-pneumatic control.

One of these locomotives, a 15-ton unit, operates over an average haul of 3,500 ft., including 1,500 ft. of 5 percent grade against loaded cars, hauling an average of 10 cars per trip, each having a weight with load of 7 tons. These cars are taken from entries and sidings where they have been placed by gathering locomotives, to the main haulageway, from which point they are taken to the tipple by older type, higher locomotives which cannot follow the advance under low headroom. Main entries are advanced several thousand feet and the

The motor frame is ribbed to obtain high capacity



20-Ton 32-Inch High Locomotive with forced ventilated motors

exact contour of the seam accurately known before any top is taken down or the grading of the main haulageway is started. Sidings, which are moved ahead every four months, and air courses and drainageways which are permanent are driven only to the thickness of the coal seam.

In this particular region, if any top at all is taken down, the total which must be taken out may be as much as 4 ft. thick. Entries are 12 ft. wide, so the total solid rock removed averages more than 5,000 cu. yds. per mile and may be more than 8,000 cu. yds. The cost of shooting, loading, and disposal of rock averages approximately $2.50 per cubic yard. It is entirely possible for a low-height locomotive, by eliminating extra rockwork, to pay for itself within a year or two through reduced mining cost quite aside from its earnings in hauling marketable coal.

How to Select the Proper Type of OVERHEAD

By H. P. CHANDLER*

CONSTRUCTION of mine trolley wire overhead has been greatly simplified by the introduction of various types of equipment and the development of suitable methods of suspension. The only problem is to select the specific type of construction and material which is best suited to the kind of mine roof or roof support on the individual property. Only by making this proper selection will it be possible to secure the most efficient overhead at the least cost.

For all practical purposes it is possible to divide the types of roof into three classifications, namely: First, natural top or roof composed of slate, coal, or some other natural material; second, timber roofs or where the point of attachment of trolley support is on a timber cross-member; and third, steel I-beams.

The natural roof being more common than either of the other two types, it offers more possibilities for a choice of construction. First, consider the method of attaching the trolley support to this kind of roof. The usual method employs an expansion bolt. These bolts generally come in two lengths, 4 and 6 in. The 4-in. length gives sufficient hold on hard, firm roofs, while the 6-in. length is used in roofs that are softer and require a greater depth of hole to gain the required holding power to support the load.

To this expansion bolt is screwed an insulated hanger. These hangers vary for different conditions. They should have ample bearing surface on the top to prevent their being "cocked" over on curves due to side pull. Many hangers are made with this broad, flat surface on the top. If it is desirable to conserve headroom, the hanger is usually made with a boss on the top which projects into the expansion-bolt hole and the bearing is secured on the collar surrounding the base as it fits up to the roof.

Hangers are usually made in various diameters to meet local conditions and have one or two petticoats to provide adequate leakage surface over the insulation. Size of hanger is dependent upon voltage and moisture conditions, greater leakage surface being needed in wet mines than in dry.

The hangers discussed above are satisfactory where the roof is practically even, but where falls have caused unevenness and it is necessary to extend the support, there are several different types from which to choose. Often if the extension is only a matter of a few inches or so, it can be made easily in the stud of the expansion bolt. If, however, the extension is greater, pipe is the usual means.

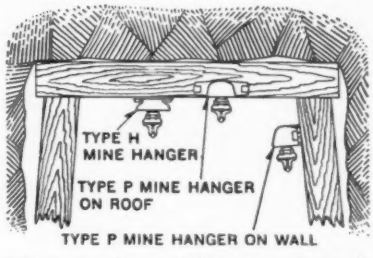


FIGURE 1—*Three different methods for attaching hangers to wood members are illustrated. Notice that the type-P hanger, on the right, requires no headroom at all*

A complete suspension unit, including a Bulldog expansion bolt, a hanger and a Bulldog clamp

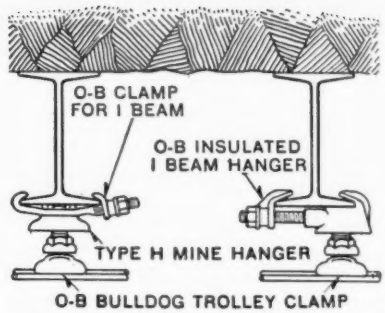


FIGURE 2—*Where I-beams are used, either the I-beam hanger, shown at the right, or the I-beam clamp, at the left, which utilizes a regular flat top hanger, may be employed satisfactorily*

There are devices available which use ¾-in. pipe, among them being the type that consists of an expansion shell which is inserted in a drilled hole and ¾-in. pipe driven into place and securely clamped. An adapter is placed on the lower end to attach the insulated hanger. The advantage of this particular type is that pipe need not be threaded; simply cut to proper length and install. The assembly and trolley wire can easily be maintained at the same elevation above the rails.

When the recesses in the roof are of considerable height, and it is felt that ¾-in. pipe does not offer sufficient strength, the size can be increased to 1¼ in. Other adapters may then be used with hangers which attach to this pipe.

Timber hangers are generally installed by means of lag screws. If a hanger has a flat top it can easily be attached to timber by means of lag-screw supports. This permits the same hanger to be used on both natural roof and timbers. If headroom is important, the hanger should be flatter. Even more headroom will be gained by using a hanger bolted to the side of the timber, as in Figure 1.

When steel I-beams are used to support the roof, it becomes necessary to change the method of support. This can be done either in the hanger itself or by using a separate clamp, to attach a standard hanger to the beam. In the O-B I-beam hanger the clamping member is an integral part of the assembly. The body is made with a hook, while a separable clamping piece slides along a threaded stud. The hanger is clamped to the beam by tightening the nut. Attachment to beams of various sizes or widths is accomplished by using longer studs to get a greater width between clamping pieces or hooks. This construction is shown in Figure 2.

* Engineer, Ohio Brass Company.

The separate clamping member employs practically the same idea with provision for the insertion of a standard flat-top timber hanger. By using this type of clamp it is possible to reduce the number of hangers regularly stocked.

Where I-beams are grounded, it becomes necessary to provide additional insulation. Experience has proved that one hanger is not sufficient to give the required insulation. This is due, probably, to the fact that when an arc is formed, as the collector passes under the ear, the resistance of air is reduced and a flashover is likely to occur. The insulation may be increased by the addition of a second insulator screwed to the hanger stud. This increases the leakage distance sufficiently to provide an installation which will not permit a flash to ground.

To complete the installation, it is necessary to attach a trolley clamp to support the wire. The clamp should have ample strength and gripping power and yet provide good clearance for the current collector. It should also be easy to install. Clamps with self-opening jaws are much easier to install than the type having jaws which must be held open while inserting the wire.

Improved Design Increases MINE CAR Efficiency

By W. H. STATLER*

MINE CAR design has taken on added significance during the past few years, not only from the standpoint of the operator but the manufacturer as well.

And what has been accomplished in this field to date is plainly indicated by the types of cars that have been developed to increase the efficiency of production.

Early this year considerable interest was centered upon a car of unusual design that was developed for use in the West Virginia field. At a single operation 500 cars of the new type replaced 550 cars of an earlier design, and within a few months the company, with the same personnel and equipment other than the cars, was benefiting by a production increase of about 400 tons a day. Each car permitted the loading of about 800 lb. more coal, owing to the gain in inside principal dimensions brought about by certain changes in design.

Although these cars are 4 in. lower than the cars they replaced, yet they have an additional level-full capacity of about 5 cu. ft. With a level-full capacity of 78 cu. ft. the loading averages 5,200 lb. per car.

Other features of these cars, aside from their all-steel riveted construction, are the drop axle, and the spring draft and buffer assembly.

Within the past few months Bethlehem introduced an all-welded light-weight type in which are embodied many desirable features that are not possessed by the former type. Different views of this car are shown in accompanying illustrations.

The Long drop-type axle and the spring draft and buffer assembly features are retained, however, with certain modifications. Forged steel wheels, equipped with anti-friction bearings, have been substituted, and the car ends have been reinforced with an end sill for draft and buffer loads.

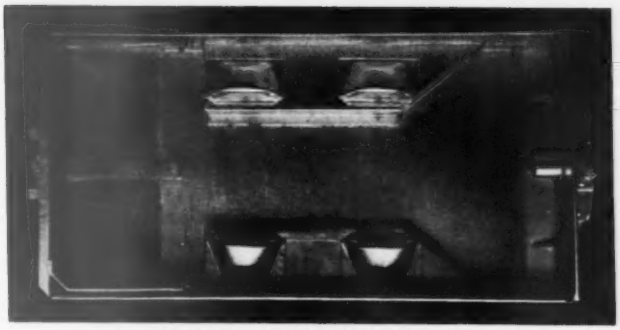
Aside from these exceptions, the car represents new design, to which is attributed increased capacity and, therefore, increased pay-load possibilities. The body construction is different than the former car, in that corrosion-resisting Mayari steel is used in car parts that come in contact with the lading, and molybdenum steel is used in all other parts.

By eliminating the body bands of the former type of car and taking advantage of the great strength possessed by these alloy steels for their thickness, a lighter-weight body of identical outside dimensions was developed. The welded underframe of this car is substantially of one-piece construction, and of comparable strength.

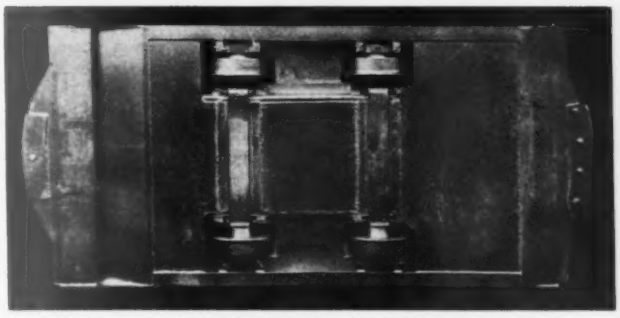
What change in design has accomplished is best illustrated by tabulating comparative figures, as follows:

	Weight empty	Level-full capacity	Weight, pay load	Pay-load efficiency
New car	3,000 lb.	80 cu. ft.	5,300 lb.	63.8%
Former car	3,940 lb.	78 cu. ft.	5,200 lb.	56.8%

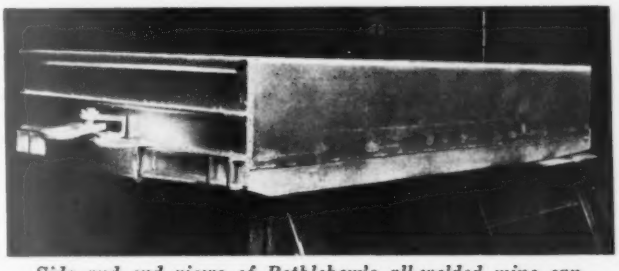
In addition to saving weight, the capacity is increased, and likewise the pay load, all of which contribute toward a 7 percent increase in production efficiency.



Interior view of Bethlehem's all-welded mine car, showing stream-lining of wheel hoods and end-gate arrangement



Underside view of Bethlehem's all-welded, alloy-steel mine car equipped with forged-steel wheels and long type drop axle



Side and end views of Bethlehem's all-welded mine car, showing smooth sides, and end sill and bumper assembly

* Bethlehem Steel Co.

Improvements in STORAGE BATTERY Reduces Transportation Costs in Mining Field

By NORTON J. BOND*

LOOKING into the future, 25 years seems an eternity; one hesitates to consider the changes that may take place with the passage of the years. But looking backward a quarter of a century, many things that stand out in our memory seem to have occurred only a short time before. Often it is hard to realize how many years have slipped by since some incident took place.

For that reason it may seem incredible to some of us, that approximately 25 years have elapsed since the storage battery locomotive was first introduced into the mining industry.

Many can recall the doubt with which these units were regarded when their introduction in some particular mine was contemplated. The value of trolley locomotives for main haulage was admitted—in non-gaseous mines. But *storage battery* locomotives . . . were they practicable? Being limited in power to the electrical energy stored in a given cubical space available on a locomotive, was the amount of work within the range of its capacity equal to that of the time-tried mule? Perhaps not for main haulage; but what about gathering service?

Many a mining man can recall the doubts that arose at that time, and *the final conviction* by actual service that, when properly installed, with due regard to the requirements of mechanical haulage the battery locomotive is a decidedly satisfactory and economical haulage unit.

An Exide-Ironclad Positive Plate. Each of those pencil-like ribs is a slotted, hard-rubber tube like the one pictured in the illustration at the upper right

Most of the batteries used at that time (of the lead-acid type), were of the "pasted" variety wherein the active material of positive and negative plates was pressed into the openings in the grid. All separators were of wood, while the jars were of hard rubber.

For years various attempts were made to find some way of retaining the active material in the plates for a longer period of time than had been possible with pasted plates. No progress was made along this line until the Exide-Ironclad type of battery was produced.

This battery utilized slotted rubber cylindrical tubes to retain the active material of the positive plates. Each positive plate was composed of a grid consisting of a horizontal top bar suspended from which were a number of parallel metal conducting rods. Surrounding each of these rods was a hard rubber tube, slotted horizontally to permit access of the electrolyte. Within these tubes and surrounding the metal conducting rods, was the active material. Another metal bar at the bottom of the plates was burned on to the conducting rods, sealing the bottoms of the tubes so that no way exists for the active material to escape except through the above-mentioned fine slots in the rubber tubes. The latter, however, while they permit easy access of the electrolyte, are too fine to allow the active material to escape readily, and so the latter remains in the tubes, keeping the plate active over a period of years.

Immediately this type of positive plate was introduced, the life of the battery was doubled and in some cases nearly trebled. Refinements and improvements have, of course, been made in the 26 years since the Exide-Ironclad type of plate was introduced and increasingly greater life has resulted, but basically it is still the same long-lived battery that first attracted the attention of the mining industry. Most recent and in a way most revolutionary of all the improvements made in this battery, was the introduction, two years ago, of latex-base separators, designed to last throughout the entire lifetime of a notably long-lived battery. These latex-base separators, although possessing all the excellent qualities of wood separators, are unaffected by heat, electrolyte and vibration.

It is gratifying to note that in obtaining longer life, none of the other desirable characteristics of the ideal locomotive battery has been sacrificed. In spite of its exceptional life, it still possesses tremendous power, is efficient on charge and imparts a good speed to a locomotive all day long.

There is no longer any doubt as to the battery locomotive's advantages over mules or horses in most mines. Mechanized processes are essential. Recognition of this fact is apparent in the number of coal-cutting machines, mechanical loaders and similar high speed adjuncts seen in many mines today.

Section of a slotted hard-rubber tube from an Exide-Ironclad Positive Plate. Note metal conducting core, surrounded by active material retained in its prison of finely slotted rubber

But without an adequate haulage system, improved facilities for cutting coal, loading it, etc., only result in costly tie-ups. Nothing is to be gained in getting the coal cut and ready for loading if cars cannot be brought up and hauled away with corresponding efficiency. The battery locomotive is an ideal unit for dependable, quick and economical shifting of cars and works most satisfactorily behind loading machines in this service.

The cost of mine haulage is continually before the mine operator. The movement of coal to the surface constitutes one of the major items in production costs. It should be the constant aim of all those interested in the industry to strive toward the improvement in transportation equipment that will bring about constantly increasing efficiency.

As an indication of what has been accomplished in the battery field to reduce the cost of mine haulage, the records show that the price of new Exide-Ironclad batteries for locomotives has been reduced 27 percent during the past 12 years, the life guarantee increased 80 percent, and guaranteed cost per month reduced to the user 60 percent.

This shows that substantial progress has been made in the battery field to reduce the cost of mine transportation.

● THE PORTABLE LAMP AND EQUIPMENT COMPANY, manufacturers and distributors of personal protective equipment for the mining industry, has moved their general offices and warehouse from 405 Penn Ave. to 72 First Ave., Pittsburgh, Pa., where the company enjoys much larger and better quarters, and a private railroad siding. William K. Wilbur, vice president of the company, has moved to Bluefield, W. Va., where he will be in charge of the southern territory for the company.

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* The Electric Storage Battery Co.

POWER FACTOR—An Ally of Efficiency . . .

UNDERGROUND DISTRIBUTION

By F. L. STONE*

IN the space allotted, it will be impossible to treat this important subject in anything like the detail it deserves. Therefore, one sample case has been selected with the hope it will indicate to the operator that a frequent survey of his entire electric system may result in the saving of many dollars.

Unfortunately, the transmission is not the only source of loss. Many fans and pumps, for instance, are and have been running for years at an efficiency far below what modern practice dictates. Improvements would pay for themselves in a very short time.

Since mechanical mining has become a reality, the problem of proper and efficient distribution becomes increasingly important. The load factor of many mines has improved greatly, the increase in some cases being from 25 or 30% to 65 and 70%. With the added and sustained loads now so common, it is necessary more than ever to look carefully over the dc. transmission. It must be remembered that every kwh. wasted in line and track losses is paid for at the same rate as is the useful energy.

Suppose for purposes of illustration we assume a condition, which I hope is an exaggeration for most mines at least, but will serve to show what may happen unless electrical wastes are watched.

Take a condition which has grown by small additions until it is found that low voltage is complained of in a section of the mine. Upon investigation, it is found that 700 amperes at 275 volts at substation is being transmitted over a 4/0 trolley and 60-pound rail return. The resistance of 4/0 wire is .0499 ohms per thousand ft. and the center of load of this section is about 4,000 ft. from the substation, so we have a total copper resistance of $.0499 \times 4 = .1996$ and a voltage drop in the copper of $.1996 \times 700 = 140$ volts. The 60-pound rail when properly bonded has a resistance of .0084 ohms per thousand ft. so $.0084 \times 4 = .0336$ = total rail resistance; $.0336 \times 700 = 23.52$ volts, so the total drop will be $140 + 23.52 = 163.5$ volts. Since the kw loss $= \frac{V \times A}{1000}$ the answer in this case is $\frac{163.5 \times 700}{1000} = 114.45$ kw.

Suppose this goes on for 8 hours per day and only 200 days per year the total kwh. lost will be $114.45 \times 8 \times 200 = 183{,}120$ kwh. This at 1 cent per kwh. means $1,831.20 total loss. Now the question naturally comes up of what will it cost to fix or at least improve this condition. The correct answer is not always so simple as it might appear. Of course, more copper could be installed which would pay for itself very quickly if the load conditions were to stay as they are or at least were to get no worse as in the case of retreating workings where the load center is coming nearer the source of power. A portable substation could be run into the load center taking its power from a bore hole or from high voltage cable strung along the rib. Local conditions are nearly always different and each particular case must be considered before any worthwhile recommendations can be made.

In the case under consideration it will be further assumed that the load will increase or at least remain the same for two years, and the load center will move away slowly during most of that time. What is the cheapest and quickest relief? Obviously, more copper will help. Try running from substation at 500,000 cm. cable paralleling the trolley all the way. Note the results—copper area will now be $500{,}000 + 211{,}000 = 711{,}000$ cm. Resistance of this copper will be .01517 ohms per thousand ft. and the resistance of the 60-pound return rails will be as before, .0084 ohms per thousand ft., or a total resistance of $.01517 + .0084 = .02357$ ohms per thousand feet and $.02357 \times 4 = .09428$ ohms for entire circuit.

The voltage drop in this circuit will be $.09428 \times 700 = 66$ volts and the kw loss will be $\frac{66 \times 700}{1000} = 46.2$ kw. 46.2 for 8 hours per day and 200 days is only 73,926 kwh. per year as compared with 183,120 kwh. as before, or a saving of $183{,}120 - 73{,}920 = 109{,}200$ kwh. per year. This is 1 cent per kwh. = $1,092.00 saving in power. The cost of 4,000 ft. of rubber covered 500,000 cm. cable would be about $.35 per ft. or $1,400.00. This would mean that the savings in power losses would pay for the copper feeder in 1 1/3 years.

In the example chosen no cost of the labor of installing the feeder has been included. This, however, will be offset many times by better voltage delivered at the face. Generally speaking, the speed of a dc. motor will drop approximately the same percentage that the voltage drops from normal. This means that the cutters take longer to move across the face. The bit speed is lower than recommended by manufacturers, and this does not, to say the least, add to the life of the bits. Conveyors travel slower and the haulage is slowed down and finally the effect on the miner is bad as his tons per hour are reduced. All of which adds to the cost per ton.

It has happened that losses can be reduced and better face voltage obtained without any addition of copper. This comes about by better and more efficient use of existing material. Suppose, for instance, there are two or more haulage entries running parallel and not too far apart to be cross connected at points some considerable distance from the substation. This would tend to equalize the load factor on the transmission, reduce the kwh. losses, and in some cases very materially improve the face voltage and, of course, with such a connection a short circuit would remove power from all parts of the network.

All of the foregoing has taken no account of many of the other methods of improving bad transmission conditions. Portable substations are indicated in many cases. Alternating current power for all machines but the haulage shows promise of large savings in some cases. This involves high voltage transmission and step down transformers at the load centers. Since the advent of the Pyranol filled transformers the fire hazard of these devices has been reduced to a minimum. Fireproof compartments are not longer necessary. Any new mine or old mine starting to mechanize on a considerable scale should give some thought to ac. motors. Voltage boosters are sometimes recommended. The only advantage gained is better voltage at the face but do not overlook the fact that the line loss is still with you and you are paying for power to compensate for it. In other words, your kwh. loss is about double, but you do get better face voltage.

In conclusion, experience seems to indicate that the operator who keeps good voltage at the face and empty cars at the face stands in the best position to make a success of his operation.

* Industrial Dept., General Electric Co.

CLEAN COAL—A Market Necessity . . .

Presented by

Link-Belt Company
Jeffrey Manufacturing Company
Allis-Chalmers Manufacturing Company
Hendrick Manufacturing Company
Roberts and Schaefer Company
The Deister Concentrator Company
Stephens-Adamson Manufacturing Company
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New Ideas Advance COAL CLEANING

By L. N. DAVIS*

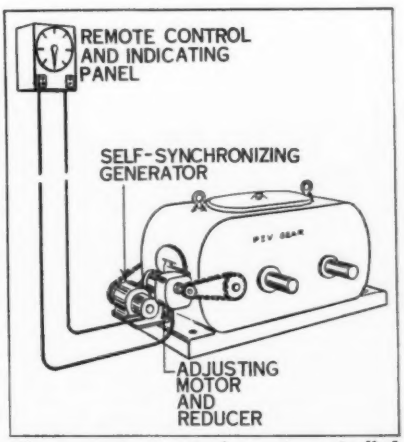
AMONG the important developments in recent years, in the process of coal cleaning by the washing method, has been the application of the principle of the electric eye to effect automatic-constant discharge of the refuse from the wash box. Many such installations have since been made.

Today, there is still another improvement that should hold great interest to all who desire to keep the coal-washing process as efficient and economical as it can possibly be made. This other feature makes it possible for the attendant *at the wash box* to regulate automatically the rate of feed of the run-of-mine coal to the coal-preparation plant or washery, in order to assure a more uniform feeding of that part of the coal which is to be cleaned in the wash box.

Such an installation may, for example, be seen at the coal-preparation plant, placed in service on January 14, 1935, by the Delta Coal Mining Company, at its strip mines in Williamson County, Ill., near Carrier Mills. This plant has a rated capacity of handling 400 tons of run-of-mine coal an hour, producing seven primary sizes. The rated capacity of the washery is 175 tons per hour, cleaning all sizes from 3-in. to 0.

Coal is obtained from the Illinois No. 5 seam at an average depth of 35 ft., the depth in the immediate vicinity of the tipple ranging from an outcrop to about 50 ft. Mining is carried on under the open-pit system, a 10-cu.-yd. electric shovel removing the overburden. A 2¾-yd. electric shovel digs the coal and dumps it into 15-ton hopper-bottom trailer trucks. These trucks transport the coal to the tipple site and dump it into a concrete hopper of 4,000 cu. ft. capacity. The photograph of the Delta plant shows one of these large trucks in position over the hopper.

The truck dump hopper is fitted at the bottom with a 42-in. reciprocating feeder to insure a uniform feed of coal to the run-of-mine anti-friction belt conveyor, which carries it up an incline to the shaker screens, from which—without getting into a discussion of too many details—the larger coal passes to hand-picking tables, and the smaller sizes over vibrating screens, to a five-cell wash box. The depth of refuse bed which is most favorable to efficient separation of refuse and coal is maintained automatically through the "Auto-Constant" refuse control, referred to briefly in the opening paragraph of this article.



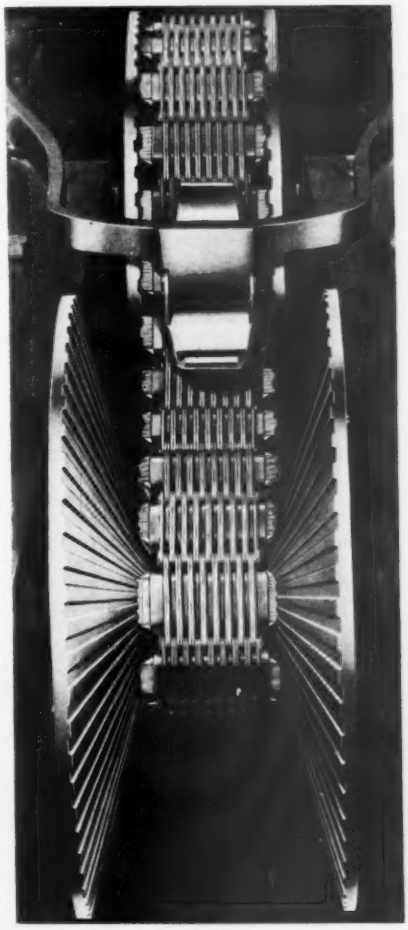
Shows arrangement of remote-controlled P. I. V. Gear variable speed transmission for regulating coal feed from primary receiving hopper

Link-Belt-built tipple and washery, Delta Coal Mining Company, Carrier Mills, Ill., showing relative positions of P. I. V. Gear and its remote control station

* Sales Manager, Link-Belt Co., Chicago.

The reciprocating feeder at the truck-dump hopper assures delivery of the run-of-mine coal to the belt conveyor at a uniform rate, which is all very well, but there presents itself at this point the added desirability of avoiding the placing of too great a load on the washing unit at any one time, since the percentage of fines and smaller lumps (to be washed), received in the run-of-mine coal, is a widely varying percentage of the whole load.

To solve this problem, a P. I. V. gear variable-speed transmission was incorporated in the drive to the feeder, to permit regulation of the rate of coal feed, at will, to suit the requirements as they arise. Whereas in the past such speed-adjusting transmissions have been regulated by hand wheel, by an attendant, at the point where P. I. V. was located, the unit installed at the Delta plant makes it possible to do all the speed regulating needed, right from the wash box. The best coal-washing results are obtained when the material is fed to wash box at a uniform rate. The remote-controlled P. I. V. gear assures that uniformity of feed in the most convenient manner.



View of chain and adjustable-wheel mechanism of P. I. V. Gear, for transmitting power. In foreground, chain is shown at minimum diameter of wheel

The standard P. I. V. gear unit is fitted with a small split-field universal type geared motor, which is connected by means of a chain drive to the speed-regulating shaft, as shown in illustration. A "fast" or "slow" button in the remote-control panel may be depressed to energize the appropriate field of the split-field motor, to increase or decrease the speed of the gear output shaft.

In order that the operator may have an immediate visual indication that the mechanism has responded to the desired change, and that he may know to just what extent he has made the change, an indicator is provided. The scale for this indicator is usually furnished without calibration, so that it may be calibrated later, as desired, whether in tons per hour, revolutions per minute, strokes per minute, etc.

The remote indication is accomplished by a self-synchronizing generator and motor, the generator being geared to the regulating shaft and the motor to the indicator. Any change in position of generator is transmitted electrically to the motor, which follows up to exactly the corresponding position. The accuracy of the self-synchronous units is not affected by the resistance of the leads, either from distance between P. I. V. and control station or from changes in temperature.

The remote-control arrangement can easily be installed on gear hand controlled variable-speed transmissions now in use.

COAL WASHING EQUIPMENT FOR SMALL TONNAGE

By W. F. BARNES*

MONTH after month we see descriptions of large-scale coal-preparation plants of 500 or 800 or 1,000 tons per hour capacity for shaft, slope or strip pit. The latest developments and machines seem to benefit the operator of large mines. But what of the smaller mines producing 100 or 200 or 300 tons per hour; what has the manufacturer and designer of coal-preparation machinery done for them?

Consider the one extremely important item of coal-washing equipment alone. Out of the great number of devices which have been developed for coal washing, it is inevitable that some type should have shown itself to be most readily adaptable to the widest range of problems. Any well-designed washer will clean coal after a fashion, but certain types have demonstrated over a period of years their ability to clean coal in the most efficient manner.

Survey discloses the jig washer as the

* Manager Coal Preparation Division, Jeffrey Manufacturing Co.

FIGURE 1.—*Two-compartment Jeffrey diaphragm jig*

predominating type at the smaller operations in the bituminous fields, the primary reason for this choice being the readiness with which these units can be worked into existing tipples. While coal-washing jigs have been in use for many years in America, many of them initially were imported from Europe, and therefore bore European specifications, which was natural, as European coal preparation antedates American practice. However, it was found that, due to the prevalence of low-gravity middlings or boney in many American coals, a different treatment from that used in Europe was required. And so certain changes, if not entirely new designs, were ordered. For this and other reasons, the operator who contemplates washing will want to make a thorough study of the performance characteristics of the various jigs, as well as other types of available washing units, from the viewpoint of his own particular needs.

In making such studies it is well to remember the prime requisites of a suitable washing unit: maximum cleaning efficiency with highest capacity and lowest operating costs and minimum degradation. Remember also that the washing unit is only part of the cost of the complete preparation plant. An investment of 20 percent additional in the washer, for a more efficient unit, will likely increase the total cost of the plant by no more than 5 percent and is certain to repay the extra expense in a short time by increasing the recovery of good coal.

For the average coal and limited tonnage, a jigging plant will usually be found economical and effective. Showing an unusually high efficiency in the cleaning of most coals, the jig has been found to be especially advantageous in the beneficiation of coal having a large percentage of flat pieces of impurities. It closely distinguishes between these flat-pieced impurities and the more cubical pieces which are coal and therefore makes a clean separation. In so doing it avoids the carrying over of the flat

impurities with clean coal, which otherwise would raise the percentage of ash in the final product.

It is only natural that the various types of jigging equipment should have gone through a long process of evolution. Different methods of producing pulsation have been tried, and the driving machinery has varied between wide limits in design and cost. Tanks and containers have been built of wood, steel, concrete, and cast iron at various stages in the development of the art. But one idea has underlain all of these developments—to produce a better and more effective way of washing coal.

As time went by, each of the types of jigging equipment developed its own peculiarities. Some demonstrated distinct limitations in washing effectiveness; some developed structural weaknesses; and others began to show high maintenance costs as they grew older in service.

Out of the experience of these years of development have come two distinct trends in the design of washing plants: on the one hand, the big-capacity units demanded by the large-scale operations, and, on the other, the more moderately priced, smaller tonnage outfit which can be justified by an operator with a more modest production.

The weaknesses in certain earlier jigs have been eliminated in the air-operated, automatically controlled Baum jigs. These larger units, however, are usually too expensive for the small mine, so unless the tonnage to be washed is 150 tons per hour or more, the Baum units will be found too large for maximum economy.

It became quite apparent that a washing unit was needed which would avoid the objections raised to the earlier jigs and give the operator of small mines the automatic control and efficient differential stroke required for best separation. A resulting design that has given unusually satisfactory results at comparatively low cost is the Jeffrey automatic-diaphragm jig (shown in Fig. 1). This jig has a welded steel tank, in the bottom of which is a moving diaphragm plate, sealed by a rubber diaphragm ring (see Fig. 2). This diaphragm is reciprocated by a cam that is specially designed and cut to impart the exact differential stroke required for maximum washing effect on any given coal. An air cushion cylinder below the diaphragm cushions the downward movement and thus acts as a flywheel to smooth out the operating cycle.

The jig is equipped with the same adjustable features and control mechanism possessed by its big brother, the Jeffrey automatic Baum jig. Length and speed of stroke and slope of jig screen are all adjustable to exact requirements. The uniformity of the refuse bed and withdrawal of refuse are automatically controlled by the "fish float," which rises and falls with any increase or decrease of refuse accumulation in the jig. This

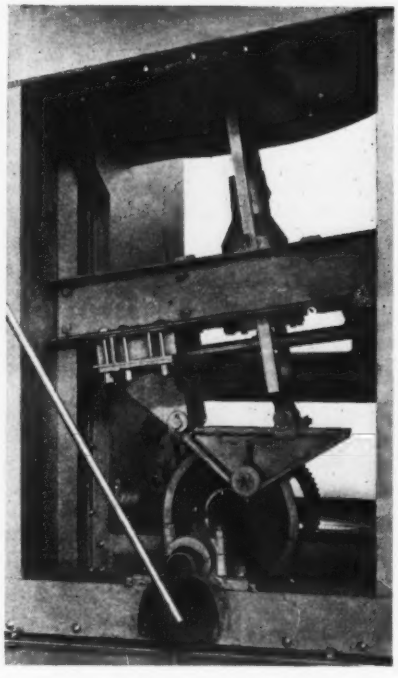


FIGURE 2.—*Drives for diaphragm and ejector mechanism on Jeffrey diaphragm jig*

automatically speeds up or retards the revolving of the positive rotary ejector which feeds reject to the refuse elevators. On the whole, the jig has been designed to meet the need for a moderate tonnage output without loss of large tonnage efficiency—which is exactly what the operator of small mines has been wanting.

Modern COAL SCREENS

By A. K. BIRCH*

FOR many years the coal industry experimented with various contrivances to screen or size coal. The earliest screens were of the stationary-bar type followed by the gravity-bar screen, developed in 1833. Flat suspended bumping screens were later used, followed by concentric cylindrical screens, which were introduced in 1867. In 1872 the first moving-grate screen was installed. This type of screen, together with similar types of swinging, reciprocating, and shaking screens, were widely adopted for coal sizing and some screens of similar design are still in use. In 1912 a new type of shaking screen was introduced in this country. This screen was horizontal, with a peculiar differentially accelerated motion which moved the coal forward.

In recent years, high-speed inclined vibrating screens of the mechanical and electrical type have been introduced and have been used with considerable success, although the long reciprocating shaker screens are still used extensively in coal tipples, the advantage of the long shaker screen being that it usually handles the entire screening problem on one screen. The disadvantages are that it does not screen efficiently, requires considerable adjustment, high power costs, and transmits considerable vibration to the building structure.

The ideal coal screen is one that has high screening efficiency. The material should travel over the entire screen surface at proper speed. Although strength and durability are essential, the design should, nevertheless, be simple, economical in operation and one that requires a minimum of attention. The amount of degradation should be the least consistent with efficient screening. It should require minimum head room; low initial cost and low installation cost are, of course, desirable but are of value only providing the design, material and workmanship are of high standard.

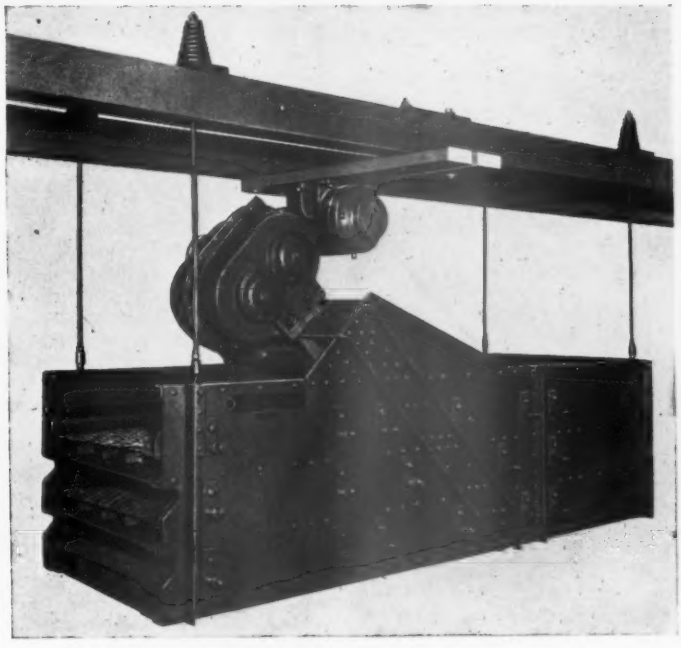
The complaint registered regarding the inclined vibrating screens is that considerable degradation is caused as the result of the coal turning around while traveling over the wire cloth, resulting in breaking off sharp corners. This has been especially noted when screening high grade bituminous coal.

We recognized the importance of designing a screen which would overcome the difficulties encountered with inclined screens and are now offering to the coal industry the low-head screen shown in the illustration. The simplicity of the design will be immediately noted by inspection.

The low-head vibrating screen is built to operate horizontally, requiring minimum amount of head room. These screens are particularly adapted to replace shaker and revolving screens and usually can be installed in existing plants by only making minor changes. The low-head screen is also desirable for new plants on account of saving in head room which results in reduced building height, and reduction in length of elevators and conveyors. This results in considerable saving not only in plant equipment but also in power required to elevate and convey material.

The vibratory action transmitted by the mechanism which can be located either above or below the screen results in material being agitated and conveyed towards the discharge end at proper speed and eliminates excessive tumbling of the material over the wire cloth, resulting in high screening efficiency and less degradation. The low-head screen is capable of handling large tonnages on comparatively short screens.

* Manager, Publicity Department, Allis-Chalmers Mfg. Co.



An Allis-Chalmers Screen

SCREENING of Coal

By D. McM. BLACKBURN*

THE screening of coal was first started in this country between 1840 and 1850 in the anthracite field. Since that time it has been a most important step in the preparation of coal for market. Within the past few years the more rigid specifications for coal demanded more accurate sizing and the manufacturers of screening equipment have devised many new and improved methods to meet the demands for better preparation.

Space does not allow an exhaustive discussion on this important subject so this article will deal only with present-day methods and materials.

Screens are generally divided into four classes: Revolving screens, stationary gravity screens, shaking screens, and vibrating screens. Revolving screens are not used to any great extent in the preparation of coal, for the reason that their use causes excessive breakage, they are not efficient, and power required to drive them is quite high. Stationary gravity screens are used at loading chutes for the removal of fines, and also at the dumps for scalping out the large sizes.

The shaking screen is used more extensively for screening coal than any other type of screen. In the anthracite field and to some extent in the bituminous field, these shaking screens are constructed of wood with light angle iron spreaders. This type of shaking screen is not very heavy and the power required to drive them is small. Most of the shaking screens in the bituminous field are of steel construction throughout and are quite heavy.

Vibrating screens have not been used up to the present time to any extent in the anthracite field, however in the bituminous field there are quite a number being used, especially for screening the smaller sizes. Vibrating screens usually operate on quite a steep pitch. Very recently several types of flat screens, that is screens which operate in a horizontal plane, have been placed on the market. Some of these screens are of the vibrating type, and others are of the high speed shaking type. The action of these screens conveys the coal over the flat screen surface. These screens have the advantage of requiring a small amount of head room. A few of them are being used for screening coal and they may be a factor in coal preparation in the future.

Practically all of the coal in the anthracite field and a large percentage of bituminous coal is screened over round hole perforated plate. Flanged lip screens are used quite extensively in the bituminous field. These screens have tapered perforations with steps or lips at the end of each row of perforations. This type of screen clears itself readily, due to the tapered shape and the lips, it causes less breakage of coal, and has a large screening area. Square mesh in woven wire and perforated plate are used at many operations. Other shapes of opening used for screening coal are rectangular, oval, short slots, long slots, squaround and hexagon.

The more modern methods of cleaning coal have caused a demand for de-watering screens; many different types of screens are used for de-watering. The important thing is to get rid of the water as quickly as possible. The most efficient type of screens used for this operation are those with elongated openings. Small size lip screens, slotted perforations, milled slots, woven wire with both short slots and with long narrow slots, wedge wire, square mesh woven wire, and small diameter perforations are used for this purpose.

While screening of coal is attended by many different conditions, generally speaking good screening can be accomplished when the coal is dry, or when it is wet, through the use of sprays. Damp material is the bugaboo of screen operation. Good screening can be accomplished when the coal contains a small amount of moisture, but screening difficulties increase with each increase in the moisture content. When coal contains an excess of moisture it must be either dried or sprays must be used to accomplish the desired results.

Good screening can also be accomplished without much difficulty on the larger sizes. However, on the smaller sizes approximately one half inch and less, screening difficulties increase with each decrease in size. These smaller sizes require much more rapid agitation to keep the particles from clinging to each other, and also to prevent the particles from forming into balls, or lumps, and also to break up any lumps or balls if already formed.

Another reason for the difficulty of screening small sizes is the thickness of the screening surface in relation to the openings through which the material passes. One of the common sizes is a 1/16 in. diameter hole in a 1/16 in. sheet or a 1/16 in. square mesh woven wire with 1/16 in. diameter wires. Screening under these conditions is just the same as trying to screen, through a 1 in. diameter hole in 1 in. thick plate, or a 1 in. square opening with 1 in. diameter wire. There is considerable frictional resistance to particles trying to pass through an opening of this kind. Decreasing the thickness of material in relation to the size of opening, results in much better screening.

* Production Manager, Hendrick Mfg. Co.

Some other conditions which effect efficient screening and make it more difficult are: dampness, moist atmosphere, rusty screens, excess amount of slack or fines in the feed, type of fracture of the coal, foreign material, such as clay, wood fibres, pieces of fuse wrappings; oil sprayed on the coal before screening.

There are many different kinds of material from which screens are made. Most of them are fabricated from common steel. Since coal is not highly abrasive, common steel makes a good screen. For the smaller sizes of coal, especially where the screening is wet or where there is acid water, screens are made from bronze, copper, brass, stainless steel, monel, nickel, aluminum and other non-ferrous and alloyed metals.

The screening of coal presents so many different problems that in almost every operation more or less experimenting is necessary in order to obtain desired results. It is therefore difficult to set down any hard and fast rules as to what type of screen, or screening surface, that will give the best results. The manufacturers of screening equipment are making applications of their product in all the different coal fields and the experience gained by the manufacturers is readily available to the operators for the solution of his screening problems.

FLEXIBILITY of DESIGN and PERFORMANCE

By RAY W. ARMS*

THE modern complicated requirements of coal sales departments have taxed to the full the ingenuity of engineers designing coal sizing and cleaning plants. In order to meet this situation, engineers have stressed flexibility of design and operation to the end that a large variety of sizes and cleaning treatments may be supplied to meet the specific needs of the coal company.

First of all is the choice between wet and dry cleaning. Several types of wet washers are offered to use either alone or in combination with pneumatic cleaners. A wide variety in these types of washeries offers the purchaser a non-competitive choice of equipment to exactly suit his requirements.

They vary from a type of washer suitable for high capacities to a separate device designed especially for low tonnages. Variations in the system are possible to provide either very low-cost equipment for the coals more easily cleaned or extra refinements to accomplish an intensely accurate separation.

The same flexibility is observed in the design of dry-cleaning plants. A type of dry cleaner is used which in extreme cases may be applied to coal as large as 3½ in. in size and is normally used for the finer sizes. This cleaner is regarded as a unit in a flexible coal-cleaning system. A unique method of retreatment makes it possible to select from several operating methods the particular routine best adapted to the coal being treated. This selection may be made without any alteration in the equipment. Such a system lends itself admirably to a coal fluctuating widely in ash content as adjustment from a high to a low rejection is accomplished by a change in the flow of coal rather than individual adjustment of the units. Furthermore, the unit system employed in air plants lends itself to wide variations in capacities.

A comparatively recent innovation in preparing fine coals is the dedusting apparatus for removing the fine-mesh sizes. A feature of dry-cleaning equipment is that at certain meshes efficient dedusting may be accomplished incidental to the cleaning without any special dedusting equipment.

An optional arrangement is the use of screens to remove fines at some larger mesh before cleaning the coal.

All dedusting systems have put a tremendous load on dust-collecting apparatus and the prevailing types of mechanical collectors sometimes show an objectionable effluent following a dedusting operation. To overcome this objection an arrangement of cloth arresters has been perfected for the purpose of precipitating all the dust in the air stream and forever remove this objectionable outside dustiness from air-cleaning plants.

* Manager, Coal Cleaning Dept., Roberts & Schaefer Co.

PREPARATION OF FINE SIZES

By D. N. GRIFFIN*

IN THE preparation of fine sizes of coal for market the vibrating screen and coal-washing table play an extremely important part. Generally speaking, these devices are applicable to the sizing and cleaning of coal of size from 1½ in. down, although in special cases both are used for the handling of somewhat coarser sizes.

Compared to other types of screening apparatus, the vibrating screen, within its sizing range, offers higher efficiency, lower first and operating costs, and higher capacity per unit of floor area. These facts have long been established in allied fields involving the preparation of ores, sand and gravel, crushed stone, etc., and are now being recognized in the field of coal preparation. For the meeting of conditions imposed by the rapidly growing practice of screening at very fine sizes, 10-20 mesh, the vibrating screen is indispensable.

There are a large number of vibrating screens of varying manufacture offered to the coal-mining industry. These differ widely in their characteristics. In the selection of vibrating screen equipment several items should receive consideration. These are, first cost, maintenance, power requirement, ease of screen-cloth change, type of means for properly tensioning screen cloth, presence or absence of vibration transmitted to supporting structure, capacity, efficiency, and the ability of the screen to keep the screen cloth openings clear. The last-named item is of particular importance where very fine screening conditions are to be met or damp coal is to be handled.

From the standpoint of efficiency of separation in the 1½-in. by 0 size range the coal-washing table is not excelled. This device was introduced to the industry approximately 20 years ago, and with subsequent improvements and mechanical developments its use has become widespread. It has found particular favor in the anthracite region of eastern Pennsylvania and the bituminous fields of Alabama and the Pacific Northwest. Also, many tables have been exported to foreign fields.

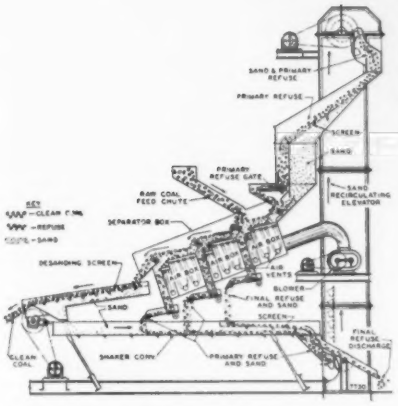
The coal-washing (concentrating) table utilizes the principles of wet gravity concentration. Originally designed for the recovery of gold, and later used on other metals comparatively more valuable than coal, the economical operation of this equipment permitted its application to coal washing. The inherent ability of the table for meeting exacting performance in the recovery of metallics and the automatic faculty of producing a full range separation from which product is taken at operator's choice for value or grade, remain with the equipment when operating in its modified and improved form as a coal-washing table.

In operation it is essentially a reciprocating flat surface upon which are attached strips commonly referred to as "riffles." While this treating surface is in all cases inclined transversely, experience shows that longitudinal inclination adjustment has a direct relation to best washing results. Raw coal is fed with water on to one corner. Dressing water is applied along one side. Clean coal is stratified above the refuse and carried by gravity and the dressing water to the coal side of the table. Heavy material, slate, pyrite, etc., settles between the riffles and is carried by them to the refuse end of the table, where it discharges according to weight in well-defined and fully separated zones. Thus, for example, the pyrite fraction produced separately though simultaneously during the coal-washing operation is available for collection as a finished product if desired. The process is continuous and is exposed to full view at all times. First and operating costs are low. Cleaning efficiency is high. On most

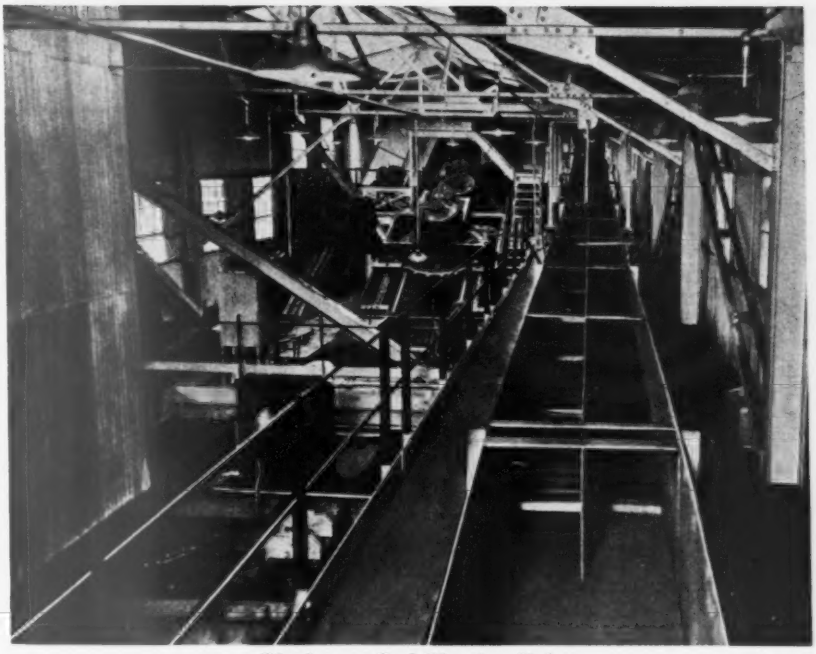
* Chief Engineer, The Deister Concentrator Co.

coals the table will produce washed coal within 1 percent of the inherent ash, and a satisfactory refuse. If desired, two or more grades of coal can be cut from the same table simultaneously and continuously.

Much investigation, design, and redesign over a period of many years has definitely established the fact that the separating surface or "deck" of the table should be of diagonal or rhomboidal design rather than rectangular. A discussion of the theory underlying this condition may be found on pages 216-217, Textbook of Ore Dressing, Richards and Locke.



A Diagram of the Air-Sand Process of Coal Cleaning



Rheolaveur Coal Cleaning Units

Preparing Clean Coal With High Recovery

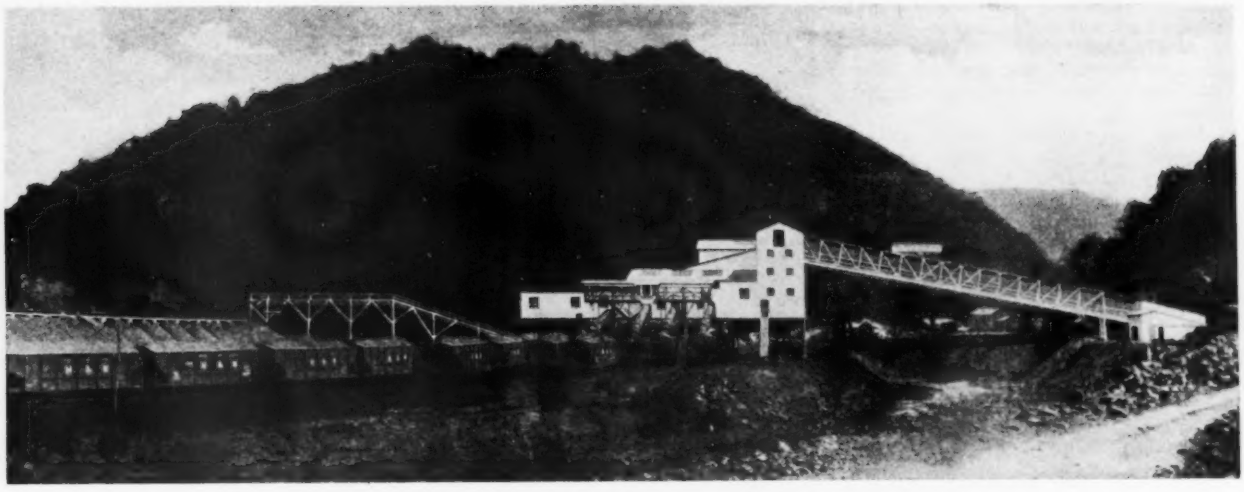
By JOHN GRIFFEN*

THE rapid adoption of mechanical loading of coal underground and the growth of stripping operations focuses attention on methods for the mechanical cleaning of coal. In both cases the impurities can seldom be removed by hand-picking and are so high as to seriously reduce the marketability of the coal, which curtails working time and thus offsets cost savings otherwise obtainable with mechanical loading. However, mechanical cleaning properly applied produces uniformly clean coal, commanding a wider market and assuring better working time for the property, with a resultant lower total cost.

During the past few years the builders of mechanical cleaning plants have developed their product and designs to meet the new needs of the coal industry, and today we can see that the production of coal is becoming a manufacturing industry where the qualities of the raw coal are modified and standardized to meet the requirements of the user. After a standard of quality is set, uniformity in product, car after car, is essential.

It is generally conceded that wet methods of cleaning are most effective and economical on the larger coal and on any wide size range, including the small slack. In the past too little attention has been paid to the matter of losses of good coal resulting from the preparation processes. With increasing wage scales, larger coal is included in that mechanically cleaned, and today 5 in. by 0 in. and even 6 in. by 0 in. coal is so cleaned. For simplicity and low capital cost, many plants have been installed

* Koppers-Rheolaveur Co.



Preparation Plant, No. 4 Mine, Pond Creek Pocahontas Company

where an attempt has been made to clean such a wide size range in one unit. Even 2 in. by 0 in. coal can rarely be efficiently cleaned in one unit. If the unit is adjusted to clean the larger coal properly, the extremely small coal is not thoroughly cleaned. To overcome this difficulty it is the practice to dewater the clean coal on relatively coarse screens and waste considerable tonnages of slurry. If, on the other hand, the unit is adjusted to effectively clean the extremely small coal, an excessive loss of larger coal is incurred in the refuse. These losses often amount to 5 percent or more of the mine tonnage and are preventable by the selection of proper cleaning plant equipment.

The Rheolaveur system recognizes these size range limitations and provides two types of equipment, one to clean large coal and the other to clean small coal. The large coal cleaning unit handles the smaller coal also without disadvantage to the cleaning of the larger coal and the expense of and the degradation from prescreening is avoided. The screens normally provided for the dewatering and sizing of the larger clean coal serve to separate the small coal which is further cleaned in the small coal unit. Due to the progressive cleaning in the two or more launders of the coarse coal unit, the small coal coming from the first launder is often fully cleaned and only that portion, about half of the total, coming from the rest of the launders needs further cleaning.

This system of cleaning small coal in a separate unit gives great flexibility. The two units can be operated at different gravities of separation and each so adjusted as to produce, when their clean coal is combined, the greatest tonnage of the desired quality. For it is usually possible, in efficient equipment, to clean the small coal separately to a considerably lower ash content than the larger coal and with a higher ash reject. The ash of the large clean coal can be made somewhat above the average and the overall recovery materially increased.

With cleaning equipment that will really clean the small coal it is essential to provide equipment that will surely recover it and reduce its moisture to a satisfactory point. Fine screens cannot be depended upon as they are subject to rapid wear which quickly causes excessive losses. A settling tank or a boot with dewatering elevator, however, can be depended upon to effectively recover extremely small coal, losing practically none larger than 48 mesh (0.01 in.) and recovering, if desired, considerable coal of smaller size. Centrifugal drier will reduce the moisture in the small coal to a point where no further water will drain from it and allow the product to be shipped without complaint.

● A MAGNETICALLY operated switch of the single-pole, double-throw type has been announced by the General Electric Company for mine gathering locomotives. Designated Type 17GM2A, it transfers the power circuit between the trolley pole and cable reel automatically, without attention from the motorman. The desired circuit can be completed only when the trolley wheel or cable hook of that circuit is placed on the wire and the other collector is withdrawn. Hand-operated transfer switches are designed to be thrown only when the power is off; if transfer is made under load, the results are destructive burning of the switch and a hazard to the motorman.

The new transfer switch has a weatherproof steel cover with spring latches, easily removed without tools. It is only 8 in. high, 5 7/16 in. wide, 10¼ in long, and weighs 25 pounds. No adjustments are required for lubrication. Bearing pins are of non-corrosive steel, and there is no wear or burning of the main (silver-to-silver) contacts. Auxiliary contacts of nonwelding alloy maintain the circuit in the last energized position. Installation requires two supporting bolts, the connection of three power cables to terminals included with the switch, and a control wire connection to ground.

The switch is available in two models: Form A1, for operation up to 250 volts and with a minimum operating voltage of 90; and Form A2, for operation up to 500 volts and with a minimum operating voltage of 180. Both forms have continuous current ratings of 200 amperes and hourly current ratings of 300 amperes.

● NEGOTIATIONS have just been completed between Hercules Powder Company, of Wilmington, Del., and the I. G. Farbenindustrie Aktiengesellschaft, of Frankfurt, Germany, by which Hercules comes into control of the American patents covering the I. G. processes on manufacturing cellulose acetate. M. G. Milliken, general manager of the Cellulose Products Department, stated that Hercules expects to be in quantity production of flake cellulose acetate by this December. The experimental and pilot units at the company's extensive cellulose products plant at Parlin, N. J., have been running successfully for several years and a material of high quality with improved properties is being produced. Work on the new large-scale plant is progressing. In its construction, the most modern units of equipment are being installed throughout.

IMPROVED VENTILATION METHODS and FANS—

Additional Savings Possible With Improved AXIAL FLOW FAN

By RAYMOND MANCHA*

NECESSITY was a motivating influence in the development and perfection of the propeller-type axial-flow fan for application as a primary ventilating machine at mines.

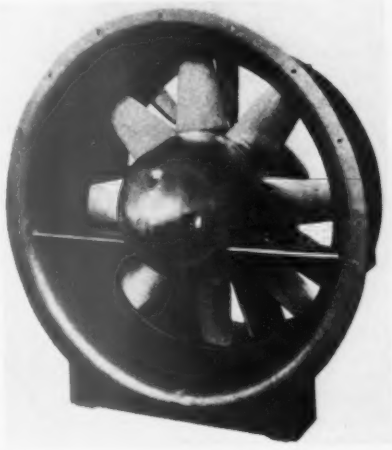
Since most mines are already equipped with a ventilating fan, and since new mines are the exception rather than the rule, it behooves the progressive manufacturer of mine ventilating equipment to devise ways and means of stimulating the market for his product. This end can be accomplished only by the development of ventilating equipment that will economically justify alteration to and replacement of existing equipment.

When savings in the annual cost of power for mine ventilation can be shown to exceed by a sufficiently attractive amount the capital charges against a proposed new installation, the mine operator will do well to take heed.

Cheaper mine ventilation in the past has been sought and accomplished by judicious mine alterations and improving ventilating machines and drives for higher efficiency. Until recently, mine fans of highest efficiency have been of the centrifugal type, somewhat expensive to buy and install and limited to surface installations, except in special cases. Increased fan efficiency has necessarily been accomplished by increased cost of purchase and installation, so that further mine ventilation cost reduction has been approaching a point of saturation. Hence the necessity for developing a less expensive, more flexible type mine fan, resulting in further concentration upon the axial-flow design.

Earlier axial-flow fans were of the flat-plate or disc type which for inherent reasons were relegated to booster work and similar low-pressure, low-energy consumption duty. Booster fans have been frowned upon because their installation in many instances is accompanied by the danger of recirculation through the fan itself. Unfortunately, many interpret this disapproval of the booster fan as applying to any and all underground fan applications. This is regrettable because the locating of a primary mine fan below ground, near the bottom of the air shaft, opens the door to further reductions in the cost of ventilation and removes the objection of recirculation.

At mines which employ two-compartment air shafts, the work done on the air by a fan located near the bottom of the air shaft usually is considerably less than the work a surface fan must perform for a specified mine ventilation requirement. This difference in work is directly attributable to leakages between the top and bottom of the air shaft. Such leakage is not confined to the separating curtain wall but occurs through the other three air-shaft walls as well, permitting



the air to short-circuit through the timbering to the adjacent hoisting compartment and into the return. Satisfactory elimination of such leaks is seldom attained. Since a fan located near the air-shaft bottom automatically eliminates this leakage, there appeared great need for an inexpensive, flexible fan for such operation, that would also permit reversing of the mine air if desired. Consequently, we decided to concentrate upon the perfection of the axial-flow fan so as to combine centrifugal-fan efficiency and stability with disc-fan flexibility and low first cost.

Aerodynamic and thermodynamic fundamentals dictated a fan design with a blade of airfoil sections in place of the flat blade of the disc fan. The result was the birth of a 12-blade propeller fan bearing the trade name "Aerovane." In performance this fan proved to be a decided improvement over that of the disc-type fan. It doubled the pressure per stage and reduced power consumption some 20 percent as compared with the disc fan. Its purchase price is only moderately higher and its installation cost the same. In fact, by crossing booster-fan design with airplane-propeller design we had succeeded in the hybridization of a primary mine fan lacking the limiting characteristics of its father but not entirely a credit to its ultra-modern mother. But we did not stop there.

Our next step was to apply the latest theory and data afforded by the splendid research efforts of the aeronautical industry. These efforts resulted in the perfection of an axial-flow fan, given the trade name "Aerodyne," which has more than doubled the pressure per stage of the "Aerovane" and has effected a further power reduction of about 27 percent. This performance compares favorably with that of the most efficient centrifugal fans available for mine ventilation. This fan has preserved the flexible characteristics of the disc fan and therefore is ideal for shaft-bottom application where it will effect still further economies, even at mines where existing surface fans are performing at highest efficiency.

To obtain highest efficiency from the axial-flow type of fan, it is necessary to go farther than merely to adopt an airfoil blade. The flow of air through the fan must be thoroughly understood and controlled. Since every fan is an adiabatic compressor, it follows that the fan of highest efficiency must approach frictionless adiabatic compression with constant entropy. This is the thermodynamic reason for the introduction of guide vanes, streamlining, etc. Aerodynamically, the air upon leaving the rotating blade has a rotational component which, unless recovered, results in excessive losses on the discharge side

(*Continued on page* 62)

* Manager Mine Ventilation Division, the Jeffrey Manufacturing Co.

"EASY ROLLING" with MODERN BEARINGS

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BEARINGS: Vital Organs vs. Heavy Equipment

By D. M. DAVIDSON*

EFFICIENCY in coal mining means mass production accomplished at a minimum cost per ton. This calls for heavy-duty equipment to operate under the most severe conditions. Ball bearings, though they may offhand seem inconsequent, are in actuality vital "organs" on which heavy mining equipment depends. They insure proper operation of expensive running parts. It is, therefore, only common sense which dictates that they receive the best of care. A $10 bearing failing in a $10,000 machine due to negligence means decidedly more than simply the cost of the bearing. It ties up expensive equipment, retards production, and may call for the replacement of parts far more costly than the ball bearing.

To obtain satisfactory service from ball and roller bearings is not a complicated matter. However, they are sensitive to mistreatment; consequently, they must receive better care than is ordinarily given machinery.

Cleanliness

The first essential in caring for ball bearings is cleanliness. This does not mean using a dirty rag to wipe off the dirt that has been allowed to collect on the bearings during disassembly, as is the usual practice with sleeve bearings. It means careful handling at all times so that there will never be any need for wiping dirt off the bearings.

Where ball bearings are to operate in particularly dirty locations, the machine designer finds it necessary to use special seals to prevent destructive dirt from entering the bearing housings. However, these seals do not protect the ball bearing from dirt introduced with the lubricant. Furthermore, they do not protect the bearings when the latter must be removed from the housings for any reason. Lubricants should be absolutely free from dirt, and to avoid contamination should be kept in carefully sealed containers. It is also good practice to clean off grease fittings before grease is introduced. In no case should an unprotected bearing be allowed to lie on the benches. Even the dust in the atmosphere that lodges on the bearings will find its way into the rolling elements.

Ball and roller bearings are made with minute internal clearances, and since there are no soft, resilient materials in the bearing, particles of dirt finding their way between the rolling elements and the raceways actually embed themselves into the hard steel surfaces. Under normal loads, the pressure per square inch between balls and raceways

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Thousands of ball and roller bearings are daily operating in the mining industry. The extremely good service of which they are capable can be obtained only when maintenance takes into account the troubles to which they are susceptible and the methods wherein they can be avoided

\+ + +

is extremely high; thus the dirt which has entered gives rise to high unit stresses, makes the bearing operate noisily, and is decidedly instrumental in causing fatigue of metal and eventually the flaking off of portions of the surface of either the rolling element or the raceway.

Particles of dirt may also lodge between the rolling element and its retainer. This results in a lapping action, which greatly reduces the diameter of the balls and increases the looseness of the bearings.

Dirt in a ball bearing is easily detected by holding the inner race and slowly rotating the outer race by hand. Any dirt in the bearing will give a bumpy feeling to the hand. This is sometimes erroneously assumed as being flat spots on the balls. Washing the bearing in clean benzine in a clean container will remove most of the dirt, but it is practically impossible to remove all of it. This fact certainly emphasizes the importance of maintaining clean bearings, so that it will not be necessary to attempt to clean them.

Lubrication

Another essential of the first magnitude in the care of ball bearings is that of proper lubrication. The satisfactory quality of a grease is difficult to insure by specifications. However, it is possible to rule out a great many unsatisfactory greases. Ordinary cup greases are not satisfactory because they have a decided tendency to deteriorate.

The primary requisites of a good ball-bearing lubricant are:

1. Protect the surfaces of the balls and raceways from corrosion.
2. Assist in the exclusion of dirt and water by forming a supplementary seal.
3. Prevent friction between balls and retainers.

The above requirements positively preclude the use of lubricants containing acid, alkali, or sulphur, which, instead of protecting, would inevitably pit or etch, and thus seriously injure the highly polished surfaces of the balls and raceways. Therefore, vegetable and animal oils which are apt to gum up, become rancid and develop acid, are not suitable for ball-bearing lubrication and should never be employed for this purpose. Moreover, lubricants containing graphite are decidedly unqualified for ball-bearing use. The reason for this is that graphite is a solid substance which tends to accumulate in the races and obstruct the free rolling action of the balls.

The ideal lubricant for a ball bearing is a pure neutral mineral oil or grease.

Where grease is being used as a lubricant, completely filling the housing has the distinct advantage of excluding dirt from entering the bearings. In other words, it prevents dirt from entering through the clearance around the shaft. The surplus grease will escape through the clearances and carry out dirt that has begun to enter. Where bearings operate at relatively low speeds so that grease churning is not a factor

* The Fafnir Bearing Co.

to consider, overfilling with grease may prove to be a wise practice. Where bearing speeds are high, however, overfilling becomes disadvantageous. One objection is that noticeable heating of the bearing develops and the usual attempt to correct this condition by the introduction of still more grease thereby aggravates this trouble. Rarely does the heat generated by grease churning injure the bearings. However, most greases will not resist the deterioration due to excessive churning and heat.

Experience has taught users of large numbers of ball bearings that periodic cleaning of housings makes for freedom from bearing failures. The following is a suggested method for cleaning out housings: Fill housing with hot oil (150° F.) and allow the bearing to turn over for about 10 seconds at full speed, then drain. Repeat until oil comes out clear. If possible, one or two men should be appointed to have full responsibility for the greasing of bearings. These men will develop the technique of caring for this work correctly. They should be provided with a list of all machines with the number of bearings on each machine.

MOUNTING

Ball bearings can be looked to for long reliable service only when properly installed. The following is given as an aid. To the man who is called upon to apply them: Before mounting a new ball bearing, check up shaft and housing for proper size and cleanliness. A worn shaft had better be replaced, as the bearing seat on the shaft must be absolutely round. If the housing bore has worn to any extent due to excessive outer rint rotation, it may become necessary to bore out the housing sufficiently to install a steel liner. The outside of this liner should be finish-turned, pressed into the housing, and pinned in place. The inside of the liner should be rough-finished only, before pressing in, and subsequently bored out to secure the desired fit of the outer ring.

No elaborate equipment is necessary for mounting ball bearings. An arbor press is desirable, especially for short shafts. Where not available, a small hammer and a piece of metal tubing to fit over the shaft are quite sufficient. If the shaft is too long or possibly not removable, an oil bath can be used quite profitably. This should be heated to approximately 300° F. and the bearing immersed in it for about 2 minutes. This will expand the inner ring sufficiently to enable the bearing to be slipped on the shaft to the proper position. On cooling, the inner ring is locked in place snugly and squarely.

With neither arbor press or oil bath facilities being available, the bearing can be driven on with light hammer blows. This is perhaps the commonest mounting method, but also requires the most care. Start the bearing on the shaft squarely by tapping it lightly all around, or, better, place a flat block (metal, not wood) across the inner ring. After the bearing has been properly started, place a piece of metal tubing against the inner ring and drive the bearing along the shaft by means of light hammer blows. The tubing slips over the shaft as the inner ring works along and enables an even pressure to be applied to it. Neither balls, retainer, nor outer ring should be struck, as the original accurate fit-up will be destroyed and the ball raceways damaged.

In the case of most ball-bearing applications, the outer race should not be a press fit in the housing, unless, of course, the housing is the revolving member. The outer ring should be a push or slip fit in the housing, which means that it can be pushed in or out by hand. A little lubricant smeared on the outside of the ring will make it slide in more easily.

In removing ball bearings from shafts which are fit for further service, care should be taken again not to strike the outer ring or balls. Apply the pressure against the inner ring either with light taps all around or, preferably, with a bearing puller. The latter device will also prove very convenient in getting the bearing out of the housing. A bearing should never be forced off by driving a cold chisel in between it and the shoulder on the shaft. Irreparable damage to both bearing and shaft is too often the result.

Anti-Friction Bearings Increase Efficiency

By E. C. REITHER*

ANY bearing used in mine service must be capable of standing up under severe conditions, regardless of the type of equipment in which it is used. Equipment is crowded to capacity at all times; it must give efficient performance with an absolute minimum of attention; the bearings are hidden away, yet must withstand shocks, high speeds, overloading, and function perfectly under both wet and dry conditions. These problems were not all solved at once, but each year has seen improvement made until today all major equipment in connection with mining operations is equipped with anti-friction bearings. In this advance the bearing companies played an important part, cooperating with equipment manufacturers and mine operators in their efforts to solve their many problems, pioneering in many instances. Today efficient bearings are standard in all types of mine equipment —cars, cutters, loaders, hoists, etc.

The time required to move cars and place them at convenient points as well as hauling loaded trains to the tipple depends in a great measure of the easy rolling properties of the cars. Anti-friction bearings on the wheels eliminate time otherwise wasted in handling cars that are hard to move. The time of the men is conserved for digging and loading coal, a more profitable occupation than moving cars. The same economies obtain on the tipple, for fewer men are required to do the work.

With the easier running properties of anti-friction bearing equipped cars, it follows logically that greater tonnage can be removed from the mines. This can be accomplished with existing power equipment regardless of the type in use. Operators have found that it is possible to increase the number of cars per train as much as 50 percent after a complete Timken installation.

A substantial factor in the cost of mining is power. Any piece of equipment or machine part which will reduce friction will naturally reduce power costs. Consequently, the application of anti-friction bearings to mine-car wheels is immediately reflected by lower power bills.

For many years the life of mine cars was limited to the life of the hubs and axles. Cars lasted as long as these parts and no longer. Now the wear in a car equipped with proper bearings is confined to the bearing itself. Thrust washer and linchpin repairs are eliminated, for none are needed. These bearings carry both radial and thrust loads. Since there is no wear in the hub or on the axle, cars never go out of service due to belled out hubs, worn axles, or for replacing worn-out thrust washers or linchpins.

A smaller number of repairmen will be able to take care of the cars, giving a saving in addition to the profit obtained by hauling a greater tonnage on the same rolling stock.

The savings, resulting from less repair time expended on the car, are increased again since the useful life of the car is extended. Many operators find that they can replace wheels, using the original bearings, thus still further increasing the life of the car as a whole.

Lubrication costs are held to a minimum with the new designs, and many operators find it necessary to grease their equipment only once a year as the large bearing chamber serves as a reservoir and the modern seals keep it in without leakage.

* Manager, Mine Car Division, The Timken Roller Bearing Company.

"More Powerful—and Smaller"

By R. R. ZISETTE*

THERE is an emissary of the Devil who is forever droning, "Make it more powerful and make it smaller; it must be more powerful and it must

* S K F Industries, Inc.

be smaller." This fiend, with his contradictory command, haunts the designer of mining machinery through each hour of his career. Just as a design, weighted with the ingenuity of the engineer's pencil, is about to leave the drafting board to be realized in the shop, this imp, this ghoul, leaps to the bending shoulder and hisses, "Very nice, but make it more powerful and make it smaller." And so the poor, harassed engineer grimly slices 2 in. off the height or width and, with a terrific wind-up, tosses in 10 more horsepower. But there is a trace of sweet in all of this bitterness, because, as he stands there in the pitcher's box, juggling the rosin bag, he finds it filled with anti-friction bearings to help control his curves. Then, with a mighty swing, Satan's side is retired once more.

Among the first applications of ball bearings to become established for regular use, we find the mine locomotive motor. This unit, contrasting with the motor for general purposes, must be of the most rugged construction to withstand the severe conditions to which all mining equipment is subjected. Furthermore, compactness is compulsory and dictated by narrow-gauge track and lowness of ceiling. Anti-friction bearings of proper design and good quality have far greater capacity per unit of volume than plain or sleeve bearings, and perhaps this advantage, more than any other, led to this early adoption. Once applied, however, experience quickly demonstrated their contribution to motor efficiency. Eliminating of bearing friction, maintaining close and constant air gap, withstanding peak overloads, and permitting higher speeds, the ball bearing materially increased the motor's effectiveness. And the operator found further advantages to score in the ball-bearing column. Lubrication was reduced to a fraction of what it had formerly been. Instead of constant vigilance by the oil can, only a small quantity of lubricant at relatively infrequent intervals was required. Distribution of bearings and expensive resultant damage to pole pieces, windings, and other parts due to refusal of the oiling system to function in cold weather disappeared as the ball bearing replaced the sleeve bearing. Not depending upon the immediate establishment and constant maintenance of an oil film, as is essential in a plain bearing, the ball bearing steps quickly and dependably into its stride, regardless of the season.

From this early adoption in motors, the use of anti-friction bearings, the ball type for some purposes and the roller type for others, has steadily spread into mining equipment of all kinds. In the modern cutting machine and in the loader, the drill, the mine car, and auxiliary equipment, one searches long and far to find a rotating part which is not supported by anti-friction bearings. More recently, in the tipple, ball and roller bearings are earning their way on the screen and on the loading boom. The latest and most efficient mine ventilating fans include anti-friction bearings in their regular specifications. Such a fan constituted one of the outstanding exhibits at the recent Mining Congress. It was at this meeting of the Congress where one soon became convinced that the anti-friction bearing, through its universal adoption in this industry, has been of material assistance to the designing engineer in keeping the aforementioned Devil's Delegate at bay.

Care of Ball Bearings in Mining Machinery

By F. O. BURKHOLDER*

MANUFACTURERS of mining machinery know from experience that the service to which their machines are subject is severe, and therefore build them accordingly. The majority use large, high grade, heavy duty bearings, well housed, and sealed against entrance of foreign matter, and therefore expect a reasonable period of service before bearing replacements are necessary. Their expectations are usually fulfilled since bearing failures and premature replacements of ball bearings installed at the factory are rare, whereas bearings installed in the field, perhaps of the same make, or others of like quality, may give a somewhat shorter period of service.

In the assembling of new coal mine equipment the work is done under ideal conditions found in a clean, well-lighted and heated plant. The men are thoroughly familiar with the design and construction of the unit they are assigned to, and have ample time to do the work properly. The parts are new, dimensions of the bearing housings and shafts are accurate, and component parts fit properly in relation to each other; as a consequence assembly goes along smoothly and a well-built machine is the result.

In contrast to this, at the average mine we have a shop suited for general repair service either above or below ground where all types of repairs must be made. The presence of dirt and principally coal dust is everywhere. The machine upon which the mechanic must work is no longer new, the parts are worn, some are broken, and the alignments of the shafts, gears, and housings have some degree of error. The closures for retaining the lubricant and excluding foreign matter are worn and will no longer provide proper isolation for revolving parts. Haste is important because coal production must continue. This is the setting for most of the repairs required at the average mine.

Ball bearings used in mine machinery are made of the finest alloy steels and are hardened from surface to center. Over-all dimensions are held to unbelievably close tolerances. Raceways and balls have, and always have had, a smooth mirror-like finish. The balls in each bearing are matched sets, each ball is the same in size, and accurate to from .000025 to .00005 of an inch, or from twenty-five to fifty millionths of an inch. Clearance between balls and raceways is practically nil.

Natural wear in a properly protected and lubricated bearing of good quality is slight and a long period of uninterrupted service can be expected as long as the clearance between raceways and balls remains at a minimum. When abrasives in the form of dust and other substances are allowed to enter, wear occurs immediately, and continues as long as this condition lasts. Remember, more anti-friction bearings are ruined because of foreign matter than by any other cause!

Tips for the Mechanic

Housings should be thoroughly washed with clean kerosene and blown out with air. Gears, sprockets, and component parts operating in a common enclosure should likewise be thoroughly washed. Shafts should be inspected for straightness, wear at bearing seats, and at keyways. A bearing which is loose upon the shaft cannot function properly. If the shafts are sprung they should be straightened or replaced. If bearing seats are worn they should be built up and machined according to dimensions recommended by bearing manufacturers and listed in their engineering specifications.

If the old bearings are to be re-installed they should be washed in several baths of clean gasoline or kerosene and blown out with compressed air. When thoroughly clean, and if found fit for further use, they should be oiled and wrapped in clean paper until ready for use. All bearings should be kept dry and wrapped in wax paper until ready for use.

Seals or closures *must be inspected very carefully* for wear. Felts, cork, or other materials, should be replaced. If long life from the anti-friction bearing is expected, the reassembled job must be as "dirt proof" as on a new machine.

Use a good quality of clean lubricant of the grade recommended by the manufacturer of the machine.

Proper mounting of bearings in relation to component parts with particular attention paid to cleanliness during assembly, and the excluding of dust during operation, will pay the operator dividends in reduced maintenance costs.

● INGERSOLL-RAND catalog 7502-E covers the company's "Type 30" line of industrial compressors and vacuum pumps. Twenty-eight pages and cover. Compressors single- and two-stage, ¼ to 15 hp., 1.2 to 102 cu. ft. per min., pressures to 1,000 lbs., vacuums to within .35" (Hg.) of barometer. Units mounted on horizontal and vertical tanks are shown; also units unmounted, and mounted on carriages.

* Vice President, Ahlberg Bearing Co.

Real Savings Through Proper Lubrication . . .

Presented by | Standard Oil Company, Indiana
The Texas Company

Influence of LUBRICATION on Production Costs

By B. L. PATTON*

THE growing necessity for raising production efficiency has caused mechanization in all branches of the mining industry to proceed at a rapid rate. In this cost-reducing trend, modern lubrication is making possible a greater realization of much needed operating economies.

In the mining industry it is notorious that equipment often operates under conditions that promote excessive wear, operation locations are frequently inaccessible to repair stations, and production schedules are set which are predicated upon the continuous, coordinated functioning of all integral units. The flow of production obviously depends on the uninterrupted functioning of every essential machine and piece of equipment. Lubrication's job is, therefore, not only one of reducing friction and minimizing wear, but particularly one of keeping the wheels turning at all times by avoiding serious breakdowns and costly idle time.

Numerous improvements have appeared in equipment and machine design which are putting a different aspect on the relatively simple lubrication requirements of times past. Many of the newer ways of doing things are boosting efficiency but as might be supposed are requiring more efficient and more highly specialized lubricants. A simple illustration is the wider use that is being made of roller and ball bearings that help so much in reducing friction and power consumption. The highly finished surfaces of these precision bearings need the best of protection against any kind or degree of corrosive or abrasive action and only the finest quality of lubricants and those particularly suited to the service conditions will provide it adequately. This is fairly representative of the greater dependence on higher quality and more specialized lubricants which is imposed by modern equipment and machine design.

Improvement in lubrication is resulting in notable reduction in costs. This can be attributed to the technical advances that have been made both in the manufacture of lubricants and in the more scientific application of lubricants. Reduction in the cost of the lubricants themselves is sometimes made through lowered consumption, but often more significant is the reduction made in the other costs that are influenced by lubrication. Reduction in *total* costs is the objective achieved through prolonging the life of equipment, minimizing wear, lowering power consumption, cutting-down repair and maintenance bills, avoiding costly interruptions of production schedules, and banishing expensive idle time.

Considerable advance has been made in the facilities afforded mine operators for a proper selection of lubricants and a proper application of lubricants. These facilities which have come to be referred to as Lubrication Engineering are extending the cost-reducing benefits already mentioned to a growing number of mining operators that recognize the need of figuring new ways to lower production expense. Lubrication Engineering, as practiced by the technically trained representatives of the oil suppliers, is doing a good job helping to put into practice in the industries it serves more scientifically devised lubrication schedules with more adequate supervision and with a better delegation of responsibility. Wherever steps of this kind are taken with genuine cooperation the potential benefits of lubrication engineering service are being very largely realized.

* Technical Department, Standard Oil Company, Indiana.

LUBRICATION Service

By ALLEN F. BREWER*

ACCURATE knowledge of the lubricating value of any oil or grease is highly desirable in the interest of economical and dependable operation of mining machinery. In this regard the theory of lubrication must be coupled with study of practical conditions to enable prediction of the extent to which certain types of lubricants will perform in actual service. This will require investigation of such products under controlled conditions of load, temperature, operating speed, means of lubrication, clearance in plain bearings, consistency of viscosity of the lubricant.

Theory of lubrication has proved that in practice a definite relationship exists between these factors. Theory, however, must be supplemented by practical laboratory study, simulating operating conditions as far as possible in order to determine the suitability of any lubricant. A better understanding of the relationship between the above mentioned conditions which may affect the performance of a lubricant will assist in more nearly complete attainment of effective lubrication.

In this connection the careful attention which has been given to the application of the theory of oil film maintenance to heavy duty mining machinery has devised a very definite function for the lubricating engineer as an exponent of lubrication service in the practical application of laboratory theories.

This service begins with the purchase of virtually any type of lubricant. Frequently it can be of the utmost value to mine executives who may be unfamiliar with operating conditions and the duty which will be required of their lubricants. It can be rendered most effectively where

* Technical Division, The Texas Company, New York.

the lubricating engineer is consulted and full advantage taken of his intimate knowledge of handling and application of lubricants, and the properties necessary for the work to be done.

It is normally possible to call in such a specialist from any reputable manufacturer of lubricants, although large mining organizations will frequently retain their own talent also for the purpose of extending their studies relative to lubrication economies and supervising their lubrication procedure. A resident lubricating engineer is a decided asset wherever a considerable volume of machinery is involved, and where impaired lubrication in any unit might seriously disrupt a production schedule.

His duties should cover direct supervision of storage facilities and means of application of all lubricants; the preparation of oiling schedules and decision as to periods for cleaning and flushing of lubricating systems; the instruction of operators as to the advantages to be derived from careful lubriation of their machinery; cooperation with the chief engineer and master mechanic in the installation of new equipment or maintenance of existing units; and study of operating conditions to determine their bearing upon selection of lubricants of specific properties or chemical characteristics. In this respect the resident lubricating engineer can check up on the specifications of any lubricant which may be offered to the purchasing department, or he can prepare his own, based on test data which he has developed, according to prevailing operating conditions on his own properties.

Lubricating engineering service as developed by certain of the most progressive manufacturers of lubricants is of decided advantage to those mines whose volume of production does not warrant the employment of a resident lubricating engineer. It is absolutely essential, however, that the sincerity of this service be investigated and that it be sponsored by a reputable oil company. To seek advice from anyone who does not have due regard for the title "Lubricating Engineer" might work to the disadvantage of the buyer, in that there would be no assurance that lubrication recommendations as offered would be dependable. Too often the unscrupulous marketer will make such recommendations to meet price competition rather than machine requirements.

On the other hand, lubricating engineering service of repute is one of the greatest assets available to the operator of mechanical equipment. It affords an especially economical way for mine executives to avail themselves of expert technical advice in regard to the solution of problems of lubrication, and the selection of lubricants capable of maintaining production most effectively, and in keeping with the accepted theories of oil film development. The lubricating engineer who represents a reputable manufacturer of lubricants will, as a rule, be intimately conversant with the many variables that should be considered.

Mobile Loader Application

(*Continued from page* 41)

tible conveyors for transportation to a central pit car loading point.

One new property opened in 1935 in a seam averaging 40 in. in thickness and equipped with mobile type loading machines constructed to an overall height of 26 in., is employing conveyor transportation from face to tipple. This operation is credited with a production of more than 10 tons per man shift, including foremen and all outside employes, for an output of 450 tons per double shift day, during the initial development period of the mine with two small mobile loaders.

Such installations reflect present trends in mechanization, not only for reduction of operating costs and the widening of profit margins but to regain and retain coal markets otherwise lost to competing fuels.

Mechanical loading is no longer an intricate and costly experimental process for the relatively few mines having ideal operations, but is now generally applied to large and small mines alike for greater cost reduction under unfavorable or thick and thin seam conditions.

Additional Savings Possible With Improved Axial Flow Fan

(*Continued from page* 57)

of the fan at the expense of "useful" pressure. This rotation also interferes with the correct expansion of the air in the discharge evase stack, which is essential to high *ventilating efficiency*.

Differentiation ought to be made between *ventilating efficiency* and *fan efficiency*. Two fans may be of equal *fan efficiency* and yet be of quite different *ventilating efficiency*. The fan with the highest *ventilating efficiency* will provide the required ventilation for the least power. *Ventilating efficiency* is always necessarily lower than *fan efficiency*. The difference depends entirely upon the design of the fan in question and the nature of the application and is at a minimum in the case of properly designed axial-flow fans. It should be realized that it is impossible for a fan manufacturer to include on his fan-performance sheet a *ventilating efficiency* curve because the *ventilating efficiency* depends upon the kind of installation made as well as upon the characteristics of the fan. In the case of industrial-fan applications the fact that the *ventilating efficiency* may be considerably lower than the *fan efficiency* is of little importance, owing to the particular nature of such installations. In mine work, however, this is not the case, and the problem becomes more involved. The axial-flow fan of proper design tends to minimize the hazards of misapplication, which is another justification for the introduction of this type of equipment to mine ventilation service.

● FURTHER SIMPLICITY and larger clearances for the various parts were secured in the Type DRT automatic d.c. motor starter, recently redesigned by the Ohio Brass Company, Mansfield, Ohio. This starter, one of five models offered by the company, was designed for automatically starting and protecting shunt or compound wound d.c. motors on conveyors, fans, pumps and other mining machinery.

A larger case allows more clearance for parts and permits mounting all equipment in the one case. An improved resistance element, consisting of one continuous wire wound on an asbestos form, makes the unit foolproof and eliminates the deterioration and breakdowns from heating which result when several short coils are used. Latch rollers, latches and steel pins of the circuit breaker are now made rustproof by chrome plating, adding to the life of these parts and making greater accuracy possible. The panel is made of a moistureproof, non-carbonizing material with high dielectric properties.

The DRT uses a relay-type starting mechanism, which starts the motor on resistance and throws the motor across the line when the speed has increased sufficiently. When power is resumed following an interruption or a severe voltage drop, the motor is restarted automatically on resistance. Overload and short circuit protection are provided by an automatic circuit breaker, fitted with a thermal element which is set for overloads of 25 percent for three minutes. No fine adjustments of any parts are necessary.

This starter is regularly furnished for 250 to 600-volt motors, ranging from 2 to 50 hp., but can be supplied in larger sizes.

SAFETY—A Fertile Field

Progress in SAFETY Equipment

By J. T. RYAN*

THE coal industry continues to search for improved methods and equipment to effect operating economies and to produce a better and more marketable product. Each mining operation has its own peculiar problems in so far as the application of production methods are concerned, and results that may be obtained are greatly influenced by natural conditions. However, one very fertile field for cost reduction that is indiscriminately open to all mining companies is *safety*, and its kindred ally, *illumination*.

The modern electric cap lamp produces such an excess of illumination that its use is no longer restricted to gaseous mines for safety considerations only, but rather it has become an accepted production tool in all types of underground operations. It has been demonstrated many times over that miners equipped with these lamps are safer because hazards can be seen, that they are more efficient, and that they produce a cleaner car of coal. Certainly the last named cannot receive too much consideration from those who must compete for sales in an exacting market.

Progressive operators have taken full cognizance of these facts as attested by the installation of more than 150,000 improved Model K Edison electric lamps, over half of which have replaced open lights in nongaseous mines.

One of the interesting developments in safety equipment that was shown for the first time at this year's Mining Congress was an electric low-velocity anemometer that will accurately read air velocities as low as 25 ft. per minute. Anemometers of the conventional vane type are inaccurate under 200 ft. per minute and fail completely at 100 ft. This restriction has left much ventilation data to be computed by such inaccurate means as the time measurement of smoke travel for given distances, or the blowing of powdered chalk into the air current.

* Vice President, Mine Safety Appliances Co.

This instrument makes a definite contribution to the development of complete and accurate ventilation surveys, and it is believed it will be widely accepted by the mining industry. Briefly, the principle of operation is based on a measurement of the cooling effect of an air current on a heated wire in circuit with a meter that is calibrated to read directly in terms of velocity in feet per minute. The design has been so carefully worked out that changes in humidity or temperature have no effect on the accuracy of the instrument.

Another ventilation aid that has been redesigned and markedly improved is the methane detector. It is now no longer necessary to periodically check the zero setting. One setting is sufficient for an entire shift, and provision is made to lock the controlling rheostat to avoid any disturbance to the setting. It is still necessary to check the temperature of the indicating filament every 20 to 30 minutes, but this is accomplished instantaneously even in a gaseous atmosphere. The weight of the instrument has been reduced from 10½ lb. to 7 lb., and the cubic dimensions or bulk reduced more than half.

All of these improved features add greatly to the utility of the detector, and the ease and accuracy of making methane determinations.

An engineer of the Bureau of Mines has stated that "three conditions must be satisfied to develop a mine explosion; first, there must be a gaseous mixture present in the explosive range; second, there must be a source of ignition; and third, both the first two conditions must occur, or be present, simultaneously." A methane detector and an anemometer accurate over a wide range are the devices designed to guard against the formation of an explosive mixture in the air current; and the replacement of open lights eliminates the most common source of ignitions.

All mining men are familiar with the contribution to safety that has been made by protective clothing in the reduction of head, foot, and eye injuries. Skullgard caps have proven to be a "natural," and although they were first developed barely more than five years ago, it is estimated that fully 70 percent of all underground workers in the United States, in both coal and metal mines, are equipped with head protection. No new models have been introduced in the past year, but present ones have been improved in comfort and durability with the addition of genuine leather linings to replace older leatherette types. The Comfo cap continues to become increasingly popular among coal miners.

Goggles and "hard toe" shoes have not been adopted to nearly the same extent as Skullgards, yet statistics indicate that the cost of eye and foot injuries combined amounts to slightly more than the cost of head injuries. Eye injuries in particular are often of such a disabling nature—and so easily preventable. Miners have been able to find so many objections to the wearing of goggles that many operators themselves are skeptical of their practicability. Yet those companies who have completed 100 percent goggle programs have proven they are extremely practical even to the extent of eliminating *all* compensable eye injuries. A recent goggle development is the Ful-Vue type. It is equipped with lens that have twice the fracture-resisting qualities of previous ones, and they are shaped to more nearly conform with the outline of the eye socket to assure more complete protection. A new pivoted-type nose bridge adds greatly to fit and comfort.

The dust problem is one that is very much in the foreground, and increasing attention is being given to the control of dust and the personal protection of the worker. Secretary Perkins, of the Department of Labor in Washington, has appointed several committees to investigate special features of the hazard, and three states: New York, Illinois, and California, have recently passed new occupational disease laws. California is the only one that has to date established a complete schedule of insurance surcharges based on the hazard prevailing in various industries, and, for mining, rates have been increased on the average 22 percent. Penalties as much as 30 percent additional may be imposed for failure to observe safe precautions, and, on the other hand, credits up to 50 percent of the surcharge will be allowed for compliance with approved safety measures. Other states will undoubtedly follow the lead of these three in the enactment of similar laws, and it may be expected that Secretary Perkins will

make definite recommendations to this effect.

Originally, it was believed that only silicates caused lung infections, and thus the term "silicosis" was used to designate the disease. Now, authorities on the subject have reached the conclusion that all forms of dust are harmful and will cause pulmonary infection to a greater or less degree; thus they prefer to use the all-inclusive term "pneumoconiosis" to designate any disease attributable to inhalation of dusts. It is therefore logical to conclude that legislation on the subject will cover all forms of pulmonary disability to which dust exposure of any kind *could* have contributed.

The U. S. Bureau of Mines anticipated this action almost two years ago when they announced a schedule for the approval of dust respirators. The Comfo respirator was the first to meet the approval of their rigid requirements, and it is certified by that authority to give complete protection in any service where a dust hazard exists.

The absence of major catastrophes in recent years has lulled many operators into a false sense of security in so far as the need for mine rescue equipment is concerned, and it is regrettable that in many instances companies have not only neglected the maintenance of such equipment, but have even failed entirely to provide themselves with it. Such a policy is decidedly short-sighted, for experience has shown that it is indeed wise to anticipate emergency conditions wherever the inherent hazards of underground mining are concerned.

In this connection, it is gratifying and extremely interesting to note the safety progressiveness that has been shown on recent large tunneling projects and the provisions made for emergency occurrences. All contractors engaged in the driving of 27 miles of sewer tunnels for the city of Chicago have been required to equip themselves with a full complement of McCaa oxygen breathing apparatus, all-service gas masks, self-rescuers, HH inhalators, CO detectors, etc. The Metropolitan Water District of Southern California has been no less emergency-minded in carrying on the driving of 92 miles of tunnel in the system required to deliver water from famous Boulder Dam to California.

Safety equipment of this type represents very cheap emergency insurance and unquestionably has a place in every underground operation.

One of the outstanding reasons for the drop in catastrophe frequency in recent years has been the wide adoption of complete and periodic rock dusting. Investigations of gas explosions very often furnish evidence that their effect has been localized entirely through the presence of rock dust. There are no outstanding improvements to report in the design of rock-dust distributors, but many bituminous companies are finding it economical to replace old-type low-pressure machines with the stationary-nozzle distributor for the reason that it will, on the average, apply 2½ times as much dust in a given time. The high-pressure distributor still finds a wide application in the dusting of back entries and air courses, and other sections or places where track is not available.

The high relative expense of accidents to the bituminous coal industry is clearly shown in statistics compiled during the code-making era of the NRA. For the 10-month period April, 1934, to February, 1935, average compensation costs for the various producing districts varied from 3.1 cents per ton to 8.6 cents—a range of 5.5 cents, or an average cost of 4.9 cents per ton. During this same period, net profit to the industry averaged only 2.7 cents per ton.

A comparison of these figures show that compensation costs for the industry as a whole are almost twice the profit per ton of coal produced, and they serve to conclusively demonstrate that *safety* offers a very fertile field for the reduction of production costs.

● WHO was the first man ever to use anthracite coal successfully? Who built the first wire rope suspension bridge? Who operated the second railroad in the United States (a railroad nine miles long and motivated by gravity)? Who turned over his wire mill to the United States Government for the casting of cannon balls during the War of 1812? Who built the first blast furnace at Mauch Chunk, Pa.? Who surveyed the Lehigh River to make it available for navigation? Who built America's first wire rope machine?

This isn't an "Ask Me Another" quiz, because all of the questions have the same answer: Erskine Hazard—as shown in the interesting exhibit of the Hazard Wire Rope Company at the recent Mining Congress Convention Exposition, Music Hall, Cincinnati.

Mr. Erskine Hazard must have been a real "he-man." Perhaps too late to be a "fore-father of America," but certainly a "fore-father of American industry." Erskine Hazard's father, Ebenezer, is said to be the first Postmaster General of the United States, and one of the first postmasters of the City of New York. While Ebenezer Hazard was not a signer of the Declaration of Independence, he was an active Revolutionary "rebel" working side by side with George Washington, Dr. Franklin, John Adams, John Jay, Hamilton, and others whose names we now revere.

But Erskine Hazard, the son, was a fore-father of industry. When yet in his early twenties, he and Captain White started a wire mill. Here they made nails and wire until the War of 1812 when the demand for cannon balls commanded their production facilities.

And it was during the year 1814, while all Atlantic seaboard cities were still feeling the pinch of coal shortage occasioned by the War, that Erskine Hazard bought two cartloads of anthracite (at the unheard-of price of $1 per bushel) for use in his pig iron furnace.

And imagine the trouble they had trying to burn hard coal, when their only experience had been with bituminous. Soft coal will blaze almost immediately. And the more draft you give it, and even the more you stir it around, the better it will burn. *That* is what they tried to do with anthracite—with absolutely no success. Indeed, Hazard, White and their mill workmen toiled all one night trying to get their small supply of hard coal to burn. Finally, about 3 o'clock in the morning they gave up in disgust, quitting the mill for their several homes. As they left the mill one of the men slammed the furnace door shut, presumably with verbal inventives hotter than the anthracite. But that man in his anger and disgust forgot his jacket, and so had to return for it, about a half-hour later. And that 30 minutes was all that was necessary to give the anthracite coal a chance to burn. When he returned to the mill the furnace door was red hot, and the interior of the furnace was at a white heat.

This discovery of a simple fact in combustion engineering: to burn anthracite just put the coal on a bed of kindling, shut the door and leave it alone—did much to encourage the early development of the anthracite industry.

● A NEW thermal-induction relay designed for use in oil-immersed motor controllers, which has tripping characteristics such that difficulty in starting high-inertia loads at full voltage is eliminated, has been announced by the General Electric Company, Schenectady, N. Y.

In the new relay, a series line-current coil produces a flux in a magnetic core, and induces a current in a copper sleeve about this core. Heat from this copper sleeve is directly conducted and radiated to a bi-metal strip whose deflection causes a set of contacts either to open or to close. The contacts, normally closed, have a slow-opening action, preventing too quick tripping on overloads. In tripping at any load, localized temperatures are much lower than with the heater-type relays heretofore used in oil, so that carbonization with resulting changes in the characteristic of the relay and sludging of the oil are avoided.

Mechanization Trends

Reports of Coal Operators Committees

Mechanical Loading Under Heavy Draw Slate

Report by the District Committee of Ohio

THE three operations covered by the accompanying tabulation have several things in common in their methods of working their machines, although each operation is using a different type of machine. All of the mines are located in the eastern Ohio coal field, two in the No. 8 seam under non-gassy conditions and one in the Middle Kittanning under deep cover and quite gassy conditions. All three use the room and pillar system of mining, formerly used for hand mining in their respective districts, with variations, however, from each other, in the width of room and entries, and the center line distances upon which they are driven.

The fact that the mines in the No. 8 seam have a 12 in. to 14 in. draw slate over the coal, creates a slate handling problem for those mines, which the mine in the Middle Kittanning seam does not have, and also causes entries to be driven quite narrow in those mines, whereas the mine in the Middle Kittanning seam can drive entries almost as wide as the rooms. Therefore, in the No. 8 seam, there are two types of unit crews. One crew, using more men, but working in wide rooms producing the real tonnage of coal, and the other crew, much smaller in man power, developing entries and room necks, for the production units. In the Middle Kittanning seam, the unit crew is the same whether on production or development.

All three mines follow the same general sequence of operations. Upon the completion of the loading operation, in a given place, slate or loose stone is taken down and gobbed, timbers set and the track extended. The coal is then undercut and drilled, following which it is shot down, ready for the loading machine.

In mine A, the cutting machine follows the loader cutting the places in the same rotation as they were loaded out. In mine C, the loader travels across the panel, with the direction of the air current, but the cutter travels across the panel just the opposite when the arcwall machine is cutting. Using shortwalls, the cutter follows the loader, but far enough back of it to allow the rock work to be done. In all three mines the machine cuts on the bottom.

Mine C reports the saving of one man on the cutting operations, divided between two unit crews, where the arcwall machine is used, since this machine cuts coal for two units in one shift.

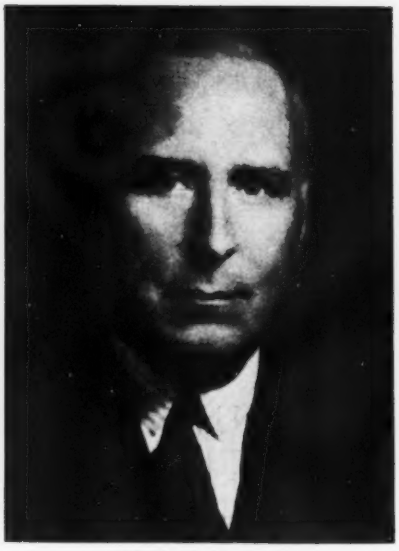
Submitted by

GEO. E. BAYLESS,
District Committee of Ohio.

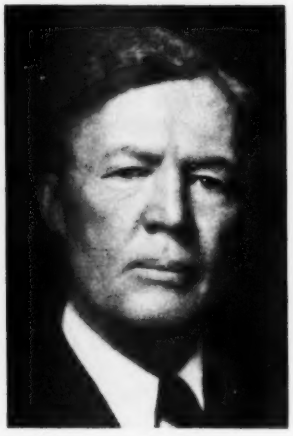
DATA SHOWING GENERAL OPERATING METHODS AND PERFORMANCES

General Conditions:	Mine A	Mine B	Mine C
Name of seam	Middle Kittanning	Ohio No. 8	Ohio No. 8
Height of seam	72"	66"	58"
Partings	2" bone	4"	3½" bone
Draw slate	None	13"	14"
Mining system	Room and pillar	Room and pillar	Room and pillar
Entry width and centers	18' wide, 40' C.	8' wide, 40' C.	9' wide, 34' C.
Room width and centers	24' wide, 27' C.	22' wide, 30' C.	26' wide, 32' C.
Working places in unit panel	4 active	12 rooms—active	5-7 rooms—active
Equipment:			
Type of cutting machine	Shortwall 7½' bar	Arcwall 9' bar	Sw. and arcwall
Type of gathering equipment	6-ton motor	Cable reel motor	4-ton motor
Type of drills	Electric	Electric	Electric
Type of explosive	Permissible	Pellet Powder	Pellet & Permis.
Capacity of mine car	130 cu. ft.	4 tons	105 cu. ft.
Operating performance:			
Men per unit loading crew	12—narrow work	7—narrow work 17—wide work	6—narrow work 10—wide work
Places loaded per shift	6 entries, 5 rooms	6 entries, 8 rooms	9 entries, 6 rooms
Cars loaded per shift	45 to 50	64 to 65	60 to 70
Cars loaded per place	8 to 10	8 to 9	10 to 12
Cars—Narrow work per shift	.....	.....	30 coal—9 slate
Cars—Narrow work per place	.....	.....	3½ coal—1 slate
Slate removal:			
Partings loaded with coal	2"	4"	3½"
Partings removed underground	None	13" top slate	14" top slate
Slate cut by machine	No	No	No
Method of loading slate—			
a. By hand into mine cars	.....	No	Yes
b. By machine into cars	.....	In entries	In entries
c. Gobbed, by hand or machine	.....	Hand in rooms	Hand in rooms
Man hours per shift for taking down and gobbing slate	.....	42 man-hrs.	21 man-hrs.

W. P. Chinn



Stanly A. Easton
National Chairman, Program
Committee



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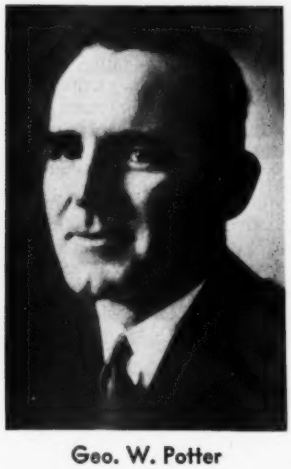

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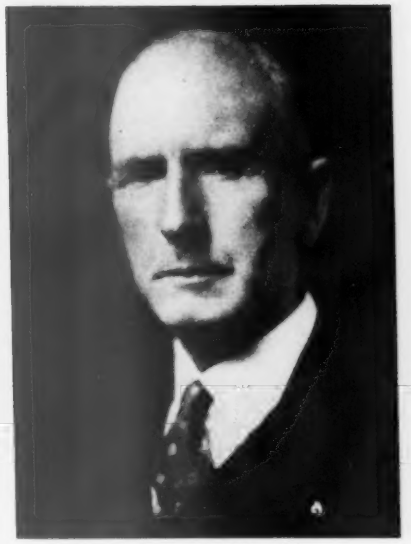


Jesse F. McDonald
Chairman, Board of Governors,
Western Division

Walter C. Clark

H. E. Treichler

● THE ANNUAL METAL MINING CONVENTION and Exposition, sponsored by the Western Division The American Mining Congress, will be held in Denver, Colo., at the Civic Auditorium September 28 to October 3, 1936. An industry-wide program committee is now cooperating with the Board of Governors of the Division, and Mr. Stanly A. Easton, national chairman of the Program Committee, in the development of a program that promises to be the best presented in many years. Suggestions for topics have been pouring into headquarters, and a lively interest is apparent. Colorado, host to the convention, is actively cooperating and is planning some unusual features of entertainment. The exposition is the most ambitious yet undertaken for this group, with more than half the available space already assigned to the leading machinery houses catering to metal mines.

Full details will appear in the August issue of THE MINING CONGRESS JOURNAL, together with the first preliminary program.

Clinton M. Roos

H. A. Coy

Jas. W. Wade

News and Views

of Interest to Mining Men

● AT the annual meeting of stockholders of the Anaconda Copper Mining Company, James R. Hobbins, vice president, was re-elected a director for the ensuing three years. William C. Potter and James H. Perkins, of New York, were elected for three years to fill vacancies. Mr. Potter is a mining engineer and is chairman of the Guaranty Trust Company. Mr. Perkins is chairman of the National City Bank. At the date of the annual meeting Anaconda had 111,478 stockholders of record.

● POPE YEATMAN and his associate Edwin S. Bery, internationally known mining engineers of New York, recently were Butte guests of William B. Daly, general manager of mines of the Anaconda Copper Mining Company.

● MONTANA section of the A.I.M.E. held a meeting in Butte on May 25, at which the principal speaker was Philip J. Shenon, of the U.S.G.S. Mr. Shenon described a trip down the Salmon River in Idaho in behalf of the National Geological Expedition.

● THE ILLINOIS ZINC COMPANY, through its president, L. E. Wemple, Chicago, announces that arrangements had been completed for the erection of a zinc smelting plant in the Panhandle of Texas where an abundant supply of low cost natural gas is available. The Illinois Zinc Company has operated a zinc smelter at Peru, Ill., almost continuously during the past 66 years, initially drawing its ore from zinc mines in northwestern Wisconsin and heating its smelting furnaces using northern Illinois coal for fuel. Later, due to the decrease in production in the Wisconsin field, it was obliged to turn to the Joplin or Tri-State field for its zinc ores, and within the past few years it has engaged in the mining of its own ores in the State of New Mexico.

The statement follows:

"The transfer of the company's smelting operations from Peru to the Texas Panhandle will take place in the early fall and on completion of the new smelter. Many of the skilled smelter men and much of the equipment used at Peru will be transferred. However, the rolling mill and coal mining operations at Peru will not be affected.

"The initial smelting plant in Texas will consist essentially of two gas-fired retort blocks, having a capacity of 24,000 tons of zinc ore concentrates and 12,000 tons of high grade smelter per annum, but it is anticipated that the Texas plant will be shortly expanded in order to smelt the increasing production of zinc ores."

● LEADING anthracite operators have announced that the lower Spring prices which were established on April 15 would receive their first mark-up on June 1, to be followed by other mark-ups in the first of each succeeding month up to and including October 1 has stimulated activity in the industry. An increase in anthracite tonnage both for May and for the first five months of 1936 is indicated over the corresponding 1935 periods.

● SUBSTANTIAL development is taking place in the silver belt of the Coeur-'d'Alenes, this including the Crescent property of the Bunker Hill & Sullivan Company. The Bunker Hill has been working the Crescent at a profit for some time. A new shaft has recently reached the ore zone and rich values, with assays said to run 250 to 400 ounces in silver.

Ores developed in the Polaris are so satisfactory that the Hecla Company has decided to sink the Polaris shaft an additional 200 ft. The Hecla also is developing the adjoining Chester where it has struck a 5-ft. vein with a streak of high grade.

Silver Dollar reports two strikes of importance. This is being developed by W. J. Stratton, of Spokane, and associates.

Announcement has been made of the resignation of Frank Eichelberger, vice-president and manager of the Sunshine Mining Co. He is giving up his work, partly because of ill health and partly because of other interests. He states that everything is satisfactory at the Sunshine, including rapid progress in sinking its new four-compartment shaft.

"Three billion pounds of lead, 60,000,000 ounces of silver and 100,000,000 pounds of zinc have been produced by the Bunker Hill & Sullivan Mining Company," Stanley A. Easton, president of the company, said in addressing the Washington and Idaho Bankers Association in Spokane, June 19. "It is probable its production will continue for many years."

● MINING is rapidly developing into major operations in the Metaline district, in the northeast corner of the state of Washington. Pend Oreille Mines and Metals Company is going into heavy production and soon will be treating 600 tons of lead and zinc ore a day. At the same time the American Zinc, Lead and Smelting Company of St. Louis, after 18 months of diamond drill exploration, is starting a 4,600-ft. deep tunnel to open ore bodies in the property of Metaline Mining and Leasing Company. These two projects make the Metaline the most important mining district in the state of Washington.

Pend Oreille Mines and Metals Company, after an extended shut down, due to low metal prices and threatened labor troubles, resumed operations last year. It rebuilt and enlarged its mill to near 300 tons capacity and now has ordered an additional 300-ton ball mill, which will bring it up to about 600 tons a day. It is understood that the company has been making a profit since it resumed operations a few months ago. With present prices, or any increase in the price of zinc and lead, profits will be increased with the doubled capacity. The company has sunk a new shaft

This is the Rebuilt and Modern Mill of Pend Oreille Mines and Metals Company Which Soon Will be Treating About 600 Tons of Zinc-Lead Ores a Day. It is Located at Metaline Falls, Wash.

—Saturday Evening Post

which has materially increased its tonnage possibilities, with ore fully as rich, if not richer, than elsewhere in the mine. If operations continue highly profitable, the corporation undoubtedly will further increase its output.

The company's head office is in Spokane, Wash. Lewis P. Larsen, of Spokane, is president of the company and Jens Jensen, secretary.

American Zinc Company holds 51 percent of the stock of Metaline Mining and Leasing Company. D. I. Hayes, of St. Louis, mining engineer, is on the ground in charge of the extensive development which American Zinc is financing. He brought in equipment in June and is starting the 4,600-ft. tunnel which has as specific objectives three ore shoots opened by the diamond drills. This company also has taken a two-year lease and option on the mill of Grandview Mines Company on the other side of the Pend Oreille river but less than five miles from the portal of the new tunnel.

● A NEW RECORD for loading lake cargo coal into ships was set at the Chesapeake & Ohio docks at Presque Isle in Toledo harbor on June 7 when 11 freighters were cargoed with 83,000 tons of coal in a 24-hour period. During that time 1,515 cars were dumped. The former record, according to T. V. Bush, coal agent for C. & O., was set on November 14, 1935, when 1,400 cars carrying 78,432 tons of coal were dumped in a like period. Coal shipments out of Toledo harbor in 1936 are expected to total 18,000,000 tons, due to the depleted coal supplies in the upper lake regions and increased industrial activity. Last year, 15,000,000 tons were shipped.

● CORNELIUS F. KELLEY, president of the Anaconda Copper Mining Company, spoke before the combined civic clubs of Butte at a dinner held at the Masonic Temple ballroom on the evening of June 4.

● A. C. WILLIAMSON, mining engineer and C. C. Pettet, business manager of the British Mining Company, recently inspected the properties of the Ground Hog Mining & Milling Company, at Argenta, Beaverhead County, which their company purchased a few months ago.

● KELLEY-TRAPP MINES, Inc. has been incorporated with 500,000 shares, par value $1. Incorporators are Dr. J. Joseph Kelley, prominent Butte business man, who holds 250,000 shares, Patrick A. Trapp, Montana mining man, who holds 249,000 shares and Harry A. Fleck of Chicago, who holds 1,000 shares. They will develop a gold property near Boulder.

● RUBY GULCH MINING COMPANY, at Zortman, Phillips County, started its coarse-crushing cyanide leaching plant on April 26 and its first gold bar assayed close to $25,000. The plant is being rapidly enlarged and is expected to be the largest gold producer in Montana. Costs of mining and milling are below the $2 per ton mark and will be reduced further as capacity is increased. George C. Whitcomb, of Zortman, succeeded his father, the late Charles Whitcomb, founder of the company, as vice president and director. Harry S. Whitcomb, of Zortman, is secretary and Carl J. Trauerman, of Butte, is president.

● THE Montana Placer Association, mine operators, have completed the work of testing a 300-acre tract of placer ground in the vicinity of Helena, Mont., and have placed an order with the Production Engineering Company, Spokane, Wash., for hydraulic gravel elevator equipment of 1,500 cu. yd. daily capacity. The equipment consists of a modern hydraulic gravel elevator and a high pressure pump of 2,000 gal. per minute capacity to supply water to the elevator. The pump will be driven by a 150-hp. engine. Among the equipment is also included a stone rake weighing 1,200 lb. which will be operated by a 40-hp. double drum dragline hoist. Other equipment consists of gold-saving tables and a

hydraulic giant. The project is backed by Seattle capital.

● DAWSON DAYLIGHT COAL COMPANY announces the incorporation of the Dawson Collieries, for which charter has been granted under the laws of the State of Kentucky. The capital stock is $100,000 preferred, 3,000 shares no par common stock. The officials of the company are as follows: W. J. Borries, president; J. S. Van Winkle, vice president; J. H. Schneider, secretary-treasurer; W. A. Borries, general manager. The company has acquired 600 acres of No. 6 seam of coal east of the city of Dawson Springs, Ky., which has been prospected with both churn and diamond core drills, and the construction of a slope to the No. 6 coal is now in progress. The property will be served by the Illinois Central Railroad with its tracks now extending through the center of the property. The corporation plans to erect a modern steel tipple and mining plant with ultimate capacity of 1,000 tons per shift. The main offices of the company bill be at 216 Breslin Bldg., Louisville, Ky., with the mine office in Dawson Springs. The Dawson Coal Company, of Louisville, is the sales agent for the disposition of the production. It is expected that the plant will be producing coal by November.

● OFFICIALS under the new alignment of the Carnegie Illinois Corp., were announced early in June, comprising present officials of Carnegie-Illinois with several officials of the American Sheet & Tin Plate Company, as follows:

B. F. Fairless, president; G. C. Kimball, executive vice president, Chicago; L. H. Burnett, vice president; Clement V. McKaig, vice president and general manager of sales; J. Halsey McKown, assistant vice president and assistant general manager of sales; W. I. Howland, vice president in charge of western sales, Chicago; J. W. Hamilton, secretary; Frank C. Harper, treasurer; O. M. Havekotte, assistant treasurer, Pittsburgh; E. B. Harkness, assistant treasurer, Chicago.

William Donald, comptroller; J. E. Lose, vice president in charge of operations; D. A. Barrett, vice president; W. C. Oberg, manager of operations, Pittsburgh district; R. B. Saylor, assistant manager of operations, Pittsburgh district; Walter Mathesius, manager of operations, Chicago district; H. G. McIlvried, assistant manager of operations, Chicago district; C. F. W. Rys, chief metallurgical engineer; Sydney Dillon, chief engineer; J. A. Hagan, chief industrial engineer; C. R. Miller, Jr., purchasing agent, Pittsburgh; F. J. Rief, purchasing agent, Chicago; Carroll Burton, vice president, Lorain division.

● ON May 26, the U. S. Bureau of Mines dedicated its new Southern Experiment Station building at Tuscaloosa, Ala. At the subsequent commencement exercises of the University of Alabama, held on the same day, an honorary degree of Doctor of Laws was conferred on the Director of the U. S. Bureau of Mines, Dr. J. W. Finch, and Doctor of Science on A. C. Fieldner, Chief Engineer, Experiment Stations Division, U. S. Bureau of Mines, and Milton H. Fies, vice president of the DeBardeleben Coal Corporation.

● TWENTY-TWO seniors of the Montana School of Mines, with Dr. Francis A. Thomson recently inspected the operations of the Alaska Juneau Mining Company. They boarded the steamship "North Bay" at Seattle to make the trip and like the song "They joined the navy to see the world." About 20 miles south of Ketchikan the ship hit a rock and all the passengers were put in lifeboats and again like the song our seniors "Saw only the sea." However, the boat was drawn off the rocks and the passengers returned to it and continued the journey. No one was injured and the "sailors" were in the lifeboats only a short time before being picked up by a coast guard cutter. As one wag put it "It's better to be 'on the rocks' before graduation than after."

● ANNOUNCEMENT was recently made at a meeting of anthracite operators, representing about 90 percent of that industry's tonnage, that an advertising and sales promotion campaign for anthracite and anthracite-burning equipment would be immediately undertaken.

The program for the campaign will be worked out as quickly as possible by a committee representing the operators and the retail dealers, and will cover the whole field of anthracite consumption. It will be financed by assessing the various companies in proportion to their anthracite production. No figures are yet available, but it is probable that the amount expended will approximate $750,000 a year.

The plan as contemplated calls for a three-year merchandising effort, and may be modified or extended as it progresses.

A number of the producing companies have in the past financed their own advertising programs, but this will be the most comprehensive effort of that nature ever put forth by the industry as a whole. As soon as the committee is named, it will meet to decide such things as the media to be used, the extent of the market to be covered, and the manner in which merchandising displays, servicing, etc., will be handled.

Because considerable anthracite tonnage has been lost in recent years to customers who wanted "automatic heat" and who did not know that this convenience could be obtained with anthracite, there will be special efforts made to demonstrate automatic anthracite stoking equipment now on the market, and probably to develop others that have not yet reached the production stage. Thermostatic control of hand-fired furnaces, anthracite service water heaters, modern anthracite cooking ranges, and other such equipment will also be brought into the picture, and advertising will be used to show present and prospective customers the best type for his particular purposes.

● THE domestic mercury industry in 1935 was maintained at about the 1934 level. Increased domestic production was accompanied by a decline in imports of metal and consumption was at virtually the 1934 rate. The quoted price for mercury was slightly lower in 1935, al-

though the average recorded for December closely approximated the highest monthly quotations for 1934.

As Italy and Spain are the largest mercury producing countries in the world, the war between Italy and Ethiopia, economic sanctions against Italy, and internal disorders in Spain raised the question of possible difficulty in obtaining supplies of mercury and increased demand for the metal in the last quarter of 1935. Sixty percent of total imports into the United States were entered in the last quarter of the year. Italy's output of mercury in 1935 totaled 25,469 flasks, nearly double the production of 1934 but much below the level of years prior to 1933. Exports of mercury from Spain are reported to have about doubled in 1935.

● ELEVEN major appropriations acts were passed by the Seventy-fourth Congress authorizing total expenditures of more than $9,500,000,000, more than $1,000,000,000 greater than by the last session. The appropriations follow:

Appropriations	1936-37	1935-36
Independent Offices (Includes Bonus, Soil Conservation in 1937)	$2,889,751,905	$777,501,956
Interior Department	114,579,357	61,220,928
Treasury and Post Office	992,524,892	903,635,678
War Department	572,446,844	401,998,170
Navy Department	526,546,532	458,684,379
Agriculture	173,565,606	125,157,983
Legislative Departments	23,314,428	20,746,760
State, Justice, Labor, and Commerce Departments	116,452,195	98,561,895
District of Columbia	43,523,910	.....
Supplemental deficiency	368,234,514	.....
First deficiency (Relief-Social Security in 1936-37)	2,375,397,537	112,633,830
Second deficiency	.....	272,901,233
Works Relief *	.....	4,500,000,000*
RFC additional appropriations	.....	500,000,000
Miscellaneous Acts	3,000,000	.....
Total by Acts	$9,716,430,863	$8,233,042,912
Debt retirement, interest	2,200,000,000†	2,200,000,000†
Total appropriations	$11,916,430,863‡	$10,433,042,912‡

** Does not include $380,000,000 unexpended balance previously appropriated.*
† Includes annual permanent appropriations. Does not require specific legislation.
‡ Does not include various authorizations to be made in later appropriations.

● THE AIR-SAND process of coal cleaning is a dry process, differing from the pneumatic tables and jigs in that a mass of fine dry sand is used as the separating medium. This sand mass is made fluid, like quicksand, by air bubbles directed upward through it. In this condition the sand flows like water.

The separator is not a table but a deep stationary box, which is kept full of this bubbling liquid sand and a stream of the fluid Air-Sand flows through the box continuously. When the raw coal is introduced into the fluid sand stream, the clean coal floats in the stream and is carried out of the box with it, while the refuse particles fall to the bottom and are discharged by transverse chutes in the bottom of the box, which discharge sand and refuse at a uniform rate regulated by means of adjustable reciprocating discharge gates shown in the drawing on page 55.

The separation is regulated simply by varying the amount of air introduced into the sand to obtain the desired specific gravity of the liquid. A small increase in the air flow makes the Air-Sand fluid lighter and permits a lighter class of refuse particles to sink, and vice versa.

The height of sand overflow is made adjustable to maintain a sufficient depth of sand fluid at the discharge end so that the refuse on the floor of the box is distinctly separated clear of the flotant coal layer before it is discharged by the gates.

The sand which flows out of the box carrying the coal and the refuse end products is recovered by desanding screens and continuously returned to the sand feed hopper to maintain uniform flow of the medium through the separator box.

To maintain uniform products with a feed of varying tonnage and refuse content, the commercial separator box is made in three compartments, constituting virtually three flotation boxes in tandem, with the same continuous sand stream flowing successively through the three boxes. The raw coal is fed to the second box and the clean coal overflowing this box is again subjected to flotation in the second box. The refuse material discharged by the slate gates of these primary coal cleaners (No. 2 and No. 3 compartments) is returned with the sand, separated from it in the sand feed hopper, and fed to No. 1 box, which is thus a primary refuse recleaner, and recovers any clean coal that might have been discharged with the first refuse from No. 2 and No. 3 compartments, thus insuring a good final refuse end product.

As the sand is continually circulated it is conditioned by drying and dedusting in the sand circulating system, so that a considerable fluctuation in moisture content of the raw coal with intermittent runs of wet coal can be handled without dampening or contaminating the sand.

Single units are made in widths of from 4 ft. to 12 ft., with capacity ratings of 25 t.p.h. to 100 t.p.h. At the plant recently placed in operation by Stephens-Adamson Manufacturing Company for the Logan County Coal Corporation, at Lundale, W. Va., two 12-ft. units are used to produce 200 tons per hour of ¼-in. by 3-in. nut and stoker coal of 4.5 to 5.0 percent ash content.

● A BRIEF summary of legislation passed by the second session of the Seventy-fourth Congress follows:

Labor.—Government contracts; Anti-Strikebreakers' Act; Air Transport Labor Act (placing employes of air carriers under Railway Labor Act); investigation into alleged interference with collective bargaining organizations.

Commerce.—Price discrimination; commodity exchange control; amendment to Securities Exchange Act to allow continuation of trading in unlisted securities.

Relief.—RFC Disaster Act authorizing RFC to loan up to $50,000,000 for rehabilitation work; Puerto Rican Rehabilitation Act authorizing relief work in Puerto Rico; Relief-Deficiency Act carrying $1,425,000,000 for WPA relief for coming fiscal year.

Taxation.—RFC Tax Exemption Act exempting bank stock holdings of RFC; Revenue Act of 1936 providing new normal and surtax rates on corporation income, the latter on undistributed earnings.

National Defense.—Largest peace-time expenditures in history with appropriations of more than a half billion each for Army and Navy; Army Air Corps Act providing for building up air fleet to total of 2,320 planes; Air Corps Reserve Act for encouraging training of reserve air pilots; and the Tin Protection Act designed to prevent and regulate the exportation of tin scrap.

Flood Control.—Omnibus Flood-Control Act authorizing $300,000,000 in flood-control and river and harbor projects; Mississippi Flood Control Act authorizing $272,000,000 in flood-control projects on the Mississippi.

Bankruptcy.—Amendment of section 77 to give U. S. voice in any railroad

reorganization proceeding in which it or its agency has a creditor interest; Municipal Bankruptcy Extension Act postponing to January 1, 1940, expiration of act; municipal bankruptcy amendment applying to drainage and irrigation districts.

Highways.—Federal Aid Highway Act authorizing appropriation of $125,000,000 each for 1938 and 1939 in grants-in-aid to states for highway construction; provisions of Interior and Agricultural Departments' appropriations bills carrying additional funds for farm-to-market and mining roads.

—— *Personals* ——

J. Carlisle MacDonald has been appointed as an assistant to Myron C. Taylor, chairman of the United States Steel Corporation, in charge of Public Relations.

James R. Hobbins, Anaconda Copper Mining Company, has been advanced to executive vice president with permanent headquarters in New York. **Dan M. Kelly**, general counsel for the company for 21 years, has been named vice president in charge of Montana operations, and **W. H. Hoover**, Great Falls attorney, has been named general western counsel.

A. George Stern, who was recently with the A. R. Maas Laboratories, of Los Angeles, Calif., as consulting chemist, has joined the U. S. Bureau of Mines staff at Washington, D. C., as Assistant to the Chief Engineer, Dr. A. C. Fieldner, Experiment Stations Division.

The Coal Information Bureau, publishers of *Mac's Coal Directory and Buyers Guide*, announces the appointment of **J. A. Morrow**, of Pittsburgh, Pa., as circulation manager and Assistant editor, effective May 15.

H. C. McElhone, who has served in various capacities in the works, headquarters sales, stock control and executive departments, has been appointed assistant to vice president of the Westinghouse Electric and Manufacturing Company.

T. J. Thomas, president, Valier Coal Company, who has been on an extended European trip has returned to this country.

J. F. Callbreath has been visiting old boyhood friends in Sullivan County, New York.

Julian D. Conover, secretary of The American Mining Congress, left July 13 for an extended western trip, which will take him to most of the important mining districts.

R. C. Allen, Oglebay Norton Company, is to be one of the delegates to the A.I.M.E. meeting scheduled for Mexico City, Mex., in October.

R. V. Tempest, Chino Copper Company, was a recent Denver visitor.

Jesse F. McDonald, president Downtown Mines Company, and prominent Colorado mining man, as chairman of the Western Division, American Mining Congress, will be the official host to the delegates to the annual meeting of that body to be held in Denver, September 28-October 3.

Stanly A. Easton, president, Bunker Hill and Sullivan M. & C. Company, has accepted the chairmanship of the Annual Metal Mining Convention and Exposition, of the Western Division, The American Mining Congress. Serving with him, as state and district chairmen are the following: **T. H. O'Brien**, Inspiration Cons. Copper Co.; **Charles A. Chase**, Shenandoah-Dives Mining Co.; **Walter C. Clark**, Bunker Hill & Sullivan M. & C. Co.; **Clinton M. Roos**, Fairview Gold Mines, Inc.; **J. C. Kinnear**, Nevada Cons. Copper Corp.; **Guy N. Bjorge**, Homestake Mining Co.; **H. E. Treichler**, Texas Gulf Sulphur Co.; **James W. Wade**, Tintic Standard Mining Co.; **George W. Potter**, Eagle Picher M. & S. Co.; **Russell B. Paul**, The New Jersey Zinc Co.; **R. M. Hardy**, Sunshine Mining Co.; **H. A. Coy**, American Zinc, Lead and Smelting Co.; **Dr. E. H. Wells**, president, New Mexico School of Mines; **W. P. Chinn**, Pickands, Mather and Co.; and **John A. Burgess**, Carsons Hill Gold Mining Corp.

Charles H. Segerstrom, president, Nevada-Massachusetts Company, has returned to his home in California after spending several weeks in the East. With Mr. Segerstrom was his son, who is a student at Harvard University.

Carl Scholz, consulting engineer, Charleston, W. Va., was in Washington during June.

A. G. Mackenzie and Mrs. Mackenzie, have returned to Salt Lake after an extended eastern trip. Mr. Mackenzie is secretary of the Utah Chapter of The American Mining Congress.

L. W. Shugg, General Electric Company, will assist in the development of the annual Metal Mining Convention and Exposition of the American Mining Congress.

A. C. Callen, University of Illinois, has been elected president of The International Kiwanis.

William Koerner has been elected a director of the Magma Copper Co.

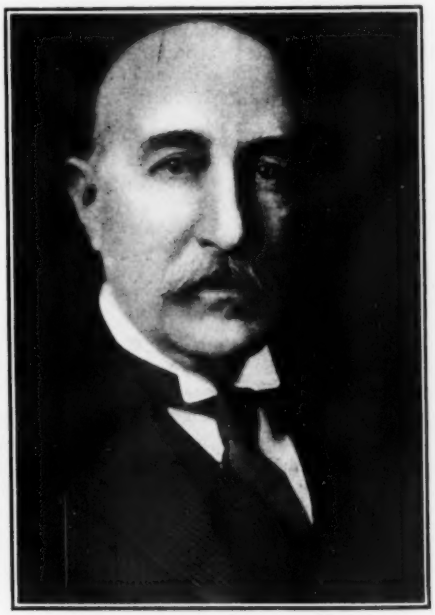
E. T. Stannard, president, Kennecott Copper Corp. and **Louis S. Cates**, president, Phelps Dodge Corp., were awarded the honorary degree of Doctor of Engineering from the Michigan College of Mining and Technology.

Among the callers at the headquarters of the American Mining Congress during the month of June were:

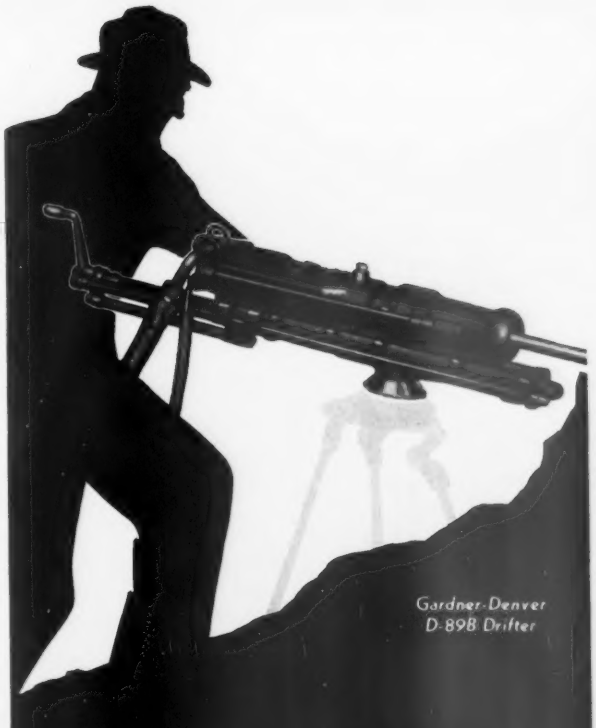
H. B. Fernald, Loomis, Suffern & Fernald; **Donald A. Callahan**, president, Callahan Zinc, Lead Co.; **I. W. Rouzer**, president, Alabama Mining Institute; **R. T. Fleming**, Texas Gulf Sulphur Co., **J. W. Allen**, Inspiration Consolidated Copper Co.; **Henry M. O'Bleness**, Berwind-White Coal Mining Co.; **Charles H. Segerstrom**, president, Nevada-Massachusetts Company; **J. F. McCarthy**, president, Hecla Mining Co.; **F. S. Elfred**, Evans Wallover Lead Co.; **Horace M. Albright**, president, U. S. Potash Company; **Roy Miller**, Texas Gulf Sulphur Co.; **Oliver M. Evans**, Evans-Wallover Lead Co.; and **Herbert S. Salmon**, Alabama Mining Institute.

—— *Died* ——

John Hays Hammond, Sr., world famous mining engineer and adventurer, died on June 8, at his home in Gloucester, Mass., at the age of 81 years—thus ending a career that will long live in the memory of the mining fraternity. Mr. Hammond's "notable work as an engineer and developer of mines both at home and abroad, his industrial leadership and his public service," for which he was awarded the William Lawrence Saunders gold medal of the American Institute in 1929, made him one of the most outstanding and colorful characters in mining history. His varied mining interests took him to many parts of the world and he had a leading part in the



development of mines in Mexico, South America, South Africa, Russia and Siberia. His experiences in the development of the great South African diamond fields, as recently related in his biography, included his arrest at Johannesburg and sentence to death at the time of the Jameson raid, formed one of the most thrilling chapters in the annals of mining.



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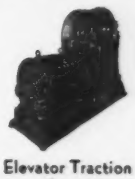
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